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AMERICAN DYESTUFF REPORTER

MONTHLY TECHNICAL SECTIONS

VOLUME 7

1920

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AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of
dyestuffs and the mechanical equipment incidental thereto

VOL. 7, NO. 7
AUGUST, 1920

IN 2 SECTIONS
SECTION 2

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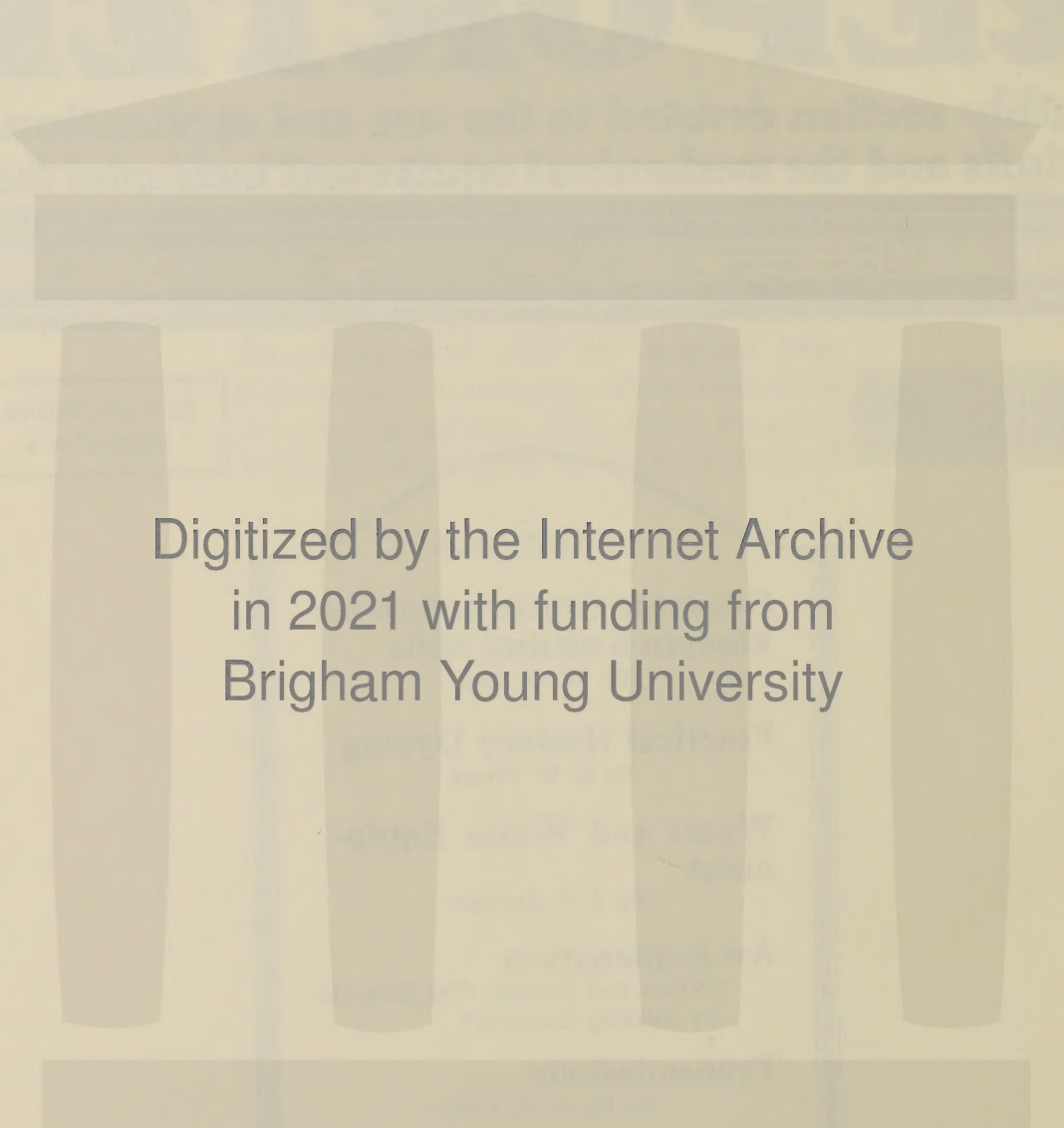
An Explanation

(Which Our Friends Will Help Us
by Reading Carefully)

Transmissions

By Dr. A. H. Lang

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AMERICAN DYESTUFF REPORTER

IN TWO SECTIONS—SECTION TWO

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

"Circulated Everywhere Dyestuffs Are Used"

Vol. 7

New York, August, 1920

No. 7

Practical Hosiery Dyeing

Written for the American Dyestuff Reporter

By E. W. PIERCE

THE first point for the dyer to consider in the dyeing of any kind of hosiery is whether the goods are in a perfectly clean condition. In the case of cotton hose to be dyed sulphur black, it makes little difference because the strong alkaline removes even machine oil and grease and few imperfections ever arise from this cause. Direct blacks also will cover well without showing spots, but in the case of fancy colors on cotton, half-silk and fiber silk, all stained pieces should be sorted out by the mill. If the mill sends dirty and oil goods to the job dyer, he is obliged to clean them before dyeing. The batch requires just as strong liquors as if every piece was soiled and the clean goods are subjected to a treatment they would be better without. Of course, for delicate blues, pinks, heliotrope, pearl, and other light fancies, every dyer knows that the goods must be full bleached, but for the deeper shades no preparation is necessary on clean goods. In such cases it is only necessary to add about 2 lbs. of soluble oil per 100 lbs. of goods directly to the dye bath. This has an emulsifying effect on any oil that may be in the goods and assists even dyeing. The knitting machines are now generally lubricated with what is called stainless oil—a transparent petroleum product, but yet unsaponifiable and just as capable of carrying fine ground metal and dirt as the deepest colored mineral oil on the market. Suggestions have been made that the stainless oil be combined with some soluble oil so it would yield more readily to the boiling out. Possibly some lubricating oils are so constructed, but it is always well to test out this feature beforehand. The dirty grease of a wagon axle is nothing but finely ground iron in mineral oils, and the stain of a knitting needle is the same thing on a small scale, whether stainless oil is used or not. All such material must be out of the goods before the dyeing is started or a number of unexplained spots may develop in the finishing and someone may be tempted to say some unkind things about American dyes.

Even if all cotton goods are to be boiled off in, say, 5 per cent of soap and 2 per cent soda ash, it will be found a great advantage to substitute 2 per cent of the soap with soluble oil. (In speaking of soluble oil, let us understand a good 75 per cent oil, not a cheap diluted variety testing about 40 per cent or less.)

After a boil-off of cotton goods it is very important to rinse every trace of soap out of the goods, not because soap is not good for the dye-bath—it is very good—but because the average dyehouse water contains so much lime and magnesia that it forms curdy masses with the soap which sticks to the goods and causes spots. In this connection it may be stated that everyone doing dyeing and scouring must count eventually upon installing a water purification apparatus, as simple filtration is not sufficient. The improvement in the quality of the dyed goods will soon repay the investment.

When the goods contain artificial silk (wood silk, fiber silk) it is well to avoid any boiling previous to dyeing, as every minute of wet working tends to raise the fiber end and makes the material more flimsy.

The preparation of half silk and silk hose for the dye-bath is a very important operation, but very often conducted by a set rule which is harmful to the goods. Handlers of raw silk recognize the existence of hard, medium and soft natured silk, although, unfortunately, it is not sold under such specifications. The throwster soaks the raw silk in an emulsion of soap and oil, often containing mineral oil, in order to soften the gum and keep it moist enough to twist evenly. The knitter runs it through an oil cup again and knits the fabric. The dyer does not know the first thing about the origin of the silk or whether it is hard or soft—to him it is simply silk in the gum and the gum must be removed before he starts dyeing. The regular silk dyer of yarns and piece goods generally pays more attention to the boil-off, but I have never seen a hosiery dyer who did not have a general formula for boil-off which he applied to what-

ever goods he handled. It is true that the gum will boil off with soap, soluble oil, soda, borax, phosphate of soda and ammonia, providing the chemicals are in sufficient quantity and the boiling is continued long enough. Since soda hastens the operation most dyers use less soap and more soda. Soap alone requires more soap and longer time. The difference between silk boiled off by the use of soda and soap only is that the fiber ends become split into many microscopic fibrillae which curl up into a tangled pellet and show on the surface as what are called "silk lice." As it is the nature of these pellets to appear light, or even white, after dyeing it is easy to see how too severe a boil-off can damage a lot of otherwise fine goods. Not only is the appearance of the goods spoiled, but it is a sure indication of the weakening of the fiber. Silk hose showing silk lice on the surface will not wear one-fifth as long as ones having a clean surface. Many a manufacturer who buys good silk may wonder why his line has not the wearing qualities of some competing line. The answer may possibly be found in the method of boiling off the gum.

A perfect boil-off may be made by using 25 per cent of pure neutral olive oil soap; some soluble oil may be added to replace part of the soap and help to emulsify the oil. A small amount of phosphate of soda—not over 3 per cent—will do no harm. The goods should be sampled after twenty minutes' boiling and the boiling continued until the sample, after rinsing, no longer feels slimy. A dyer will soon be able to recognize when the gum is gone and the boil-off should be stopped *at once* and the goods rinsed; any further boiling will begin to injure the silk.

The actual dyeing of hosiery needs little more comment. There is really nothing to be said regarding the application of direct dyes to all-cotton goods. When dyeing goods containing both mercerized and plain cotton the contrast between the two is less if dyed below a boil with 2 per cent of phosphate of soda and not over 10 per cent of salt. Similarly, when the mercerized yarn is uneven and tends to show stripes around the stocking, the same method will be a help, but the dyer must not be blamed for such stripes if they do appear—they are the fault of the mercerizer of the yarn and show that only one end of the original skein was well mercerized.

With artificial silk, the less working and boiling the better the goods will look. Use soluble oil and phosphate in the bath to assist evenness and there will be less need of hard boiling. The ordinary varieties of artificial silk always will dye deeper than even mercerized cotton, and no satisfactory method has so far been found to correct it. With sulphur blacks on cotton goods avoid an excess of salt. Take the gravity of the boiling dye liquor *after* the addition of fresh dye and sulphide and do not add salt unless it falls below 6 deg. Tw. Adjust the sulphide so that the goods rinse clean on the third rinse. If they seem clean after one rinse there is too little sulphide and they will be dull and may crock badly, but if they still give a bluish or greenish tint to the third rinse, the sul-

phide may be cut down a little. Too much sulphide gives thin greenish blacks. Softening after sulphur black not only improves the shade but leaves enough alkali on the goods to counteract any tendency to become tender. Tendering is a special subject in itself, but here may be summed up by saying that all sulphur blacks are alike in this respect and in the course of time will tender the goods if means are not taken to prevent it. When goods are scrooped, or aftertreated with copper salts, the effect takes place more quickly. Afterchroming is the surest preventive, but treatment with sodium acetate, silicate or alkaline softeners will preserve the goods until after their first washing by the consumer.

Most of the half-silk hosiery on the market, with the exception of blacks, show very wide variations in the shade of the silk and cotton. Before the war dyers had very little trouble in this respect, because they selected dyes that would give uniform shades on both fibers. To-day some are actually using such dyes as Chrysamine Congo Red and shading with Direct Black to make their Cordovan and Havana shades. This is one of the reasons the public has formed an unfavorable opinion of our American colors. This, not being an advertising article, is not the place to tell just which dyes to use, but there are several American manufacturers who are making a full line of proper colors and who will be very glad to give the prospective user full information. It is almost unnecessary to state that the dyer who endeavors to use only the cheapest dyes will be the least successful. In dyeing the object should always be to use the best and most suitable color for the purpose, and if it does cost more than one less suitable the extra cost can always be passed along to the consumer. Any consumer would rather pay the few cents extra than have a high-priced pair of stockings show unsightly colors after the first laundering.

In dyeing half silk the bath should be nearly neutral, barely on the alkaline side and the temperature about 180 deg. Cooler than this will fill the cotton and leave the silk pale, while hard boiling will make the silk a full shade with the cotton thin. As most direct dyes tend to make the silk more brilliant than cotton a little neutral dyeing black, like Sulphon Cyanine Black BB, will assist an even tone on almost all shades—but it must be used very sparingly.

There is quite a demand to-day for two-tone or shot-dyed effects and there are also many dyes that dye either one fiber or the other. Two-tone effects may be obtained in one bath with ease. Goods where the cotton is deep black and the silk white or in bright colors are made in two ways. The goods are dyed below 100 deg. Fahr. with Diazo Black BH in the presence of 2 per cent soda; this colors the cotton navy blue and leaves the silk white. Then they are rinsed and diazotized and developed with black developer. Unfortunately, while the dye leaves the silk fairly white the nitrite solution also diazotizes the silk itself and the developer couples with it to give a dull orange color. This is not objectionable when the silk

is to be cross-dyed in fancy acid colors but unfits it for black and white effects. The best black and white effects are to be obtained by dyeing Sulphur Blacks cold in the presence of glue. In such cases the silk is not boiled off first, but after dyeing.

I have purposely avoided giving other than generally known names of dyes, but suggest that the dyer keep in

close touch with the manufacturers and well posted on new developments and as the industry makes progress he will be the first to benefit. We have a duty to show Europe that we are going to run on our own resources as far as possible and no one can demonstrate this better than a dyer who will strive to produce high class results with our American dyestuffs.

Water and Water Equipment

By J. F. SPRINGER

WATER is represented, chemically, by the formula H_2O ; and yet the great bulk of what is ordinarily termed water contains other substances than the gases H and O. These other substances are sometimes in solution, sometimes in suspension, sometimes in the form of an admixture. Generally, what is wanted in the color factory, the textile mill and the dye-house is simple water; so that, if other substances are in any way to be added, they may be added to the simple article. In general, it is practically impossible to secure a commercial supply of absolutely pure water. The thing to do, in view of this fact, is to treat the water mechanically, chemically or in some other way, and seek to eliminate deleterious matter, or nullify substances which cannot be removed.

In the textile and dye industries, water is largely used because of its solvent power. It is, in fact, probably the greatest known solvent in the world, dissolving a greater range of substances than any other known liquid. In general its solvent power varies greatly with the temperature, heat increasing the power. One of the most notable instances of this concerns the solubility of common alum. Chemically, this substance is known as aluminum ammonium sulphate, $Al_2(NH_4)_2(SO_4)_4 + 24 H_2O$. When water is at the boiling point, it will dissolve nearly 47 times as much alum as it will when cold. On the other hand, boiling water dissolves rather less calcium sulphate than does cold water. Sodium bichromate is displacing potassium bichromate as a mordant and in other connections. Doubtless the comparative cheapness accounts in part for this; but the much greater solubility of the sodium compound must also be a considerable factor. Thus, cold water will dissolve 11 times as much sodium bichromate as potassium bichromate; and boiling water will dissolve more than twice as much of the sodium as of the potassium compound.

Water dissolves gases as well as liquids and solids. The effect of heat, however, is the reverse in the two cases. In general, the lower the temperature of the water, the greater will be the volume of gas that may be dissolved in it. The gases differ profoundly in their

capability of responding to the solvent power of water.

Nitrogen is low in the scale. At 59 deg. Fahr. (= 15 deg. Cent.), about 15 c. c. of nitrogen may be dissolved in 1 liter (1000 c. c. of water. Hydrogen is somewhat more soluble; any oxygen has a still greater solubility. But these gases have only moderate degrees of responsiveness to the solvent action of water. Toward carbon dioxide and sulphureted hydrogen, water shows much greater solvent action. Carbon dioxide is soluble in the proportion of 1 volume of gas to 1 volume of water and sulphureted hydrogen 3.2 volumes to 1 of water. With sulphur dioxide, we get to a still higher proportion; for this gas is dissolved up to 43.5 times the volume of the water. This seems remarkable; but hydrochloric acid and ammonia totally eclipse all other gases so far mentioned, the one being soluble to 462 and the other to 727 times the volume of the water which acts as solvent.

Because of the great range of substances over which water exerts a greater or less solvent power, it is almost impossible to find pure water in nature. Exposed to the atmosphere, in the form of rain or otherwise, water dissolves oxygen, nitrogen and carbon dioxide. Percolating through the ground, it everywhere dissolves solids with which it comes into contact.

Rain water is said never to be free from carbon dioxide, nitric acid, nitrous acid, ammonia, oxygen and nitrogen. Usually there is present more or less organic matter in a finely divided state. This organic matter doubtless comes from suspended matter in the atmosphere. If the rain water is collected in centers of population where a great deal of bituminous coal is burnt, sulphuric acid is to be expected as a constituent. The sulphuric acid content comes undoubtedly from that of the coal or of the gases of combustion. Naturally, the impurities in rain water that are due to solid impurities in the atmosphere will be largely concentrated in the first fall of rain. Similarly, with the impurities accumulated from roof and spout. For these reasons it is well as a rule when collecting rain water for industrial purposes to discard the first of it. After the atmosphere has been well washed, and also the roof and the spout, the water will ordinarily

be decidedly purer. As rain water is soft water, a good many concerns might do well to consider the possibilities of collecting such water under favorable circumstances and then using it for various purposes. It is recommended for *scouring*. If the combined *plan area* covered by the roofs of a plant amount to 0.4 acre, then, if the annual rainfall is 35 inches, there will run off from these roofs an average of 1000 Imperial gallons per working day. If the plant in which the reader is interested has a roofed area different from 0.4 acre, the result of the yearly fall of rain may still be calculated from the result above. Thus, if the plan area covered by roofs is 0.3 acres, the daily average of rain water obtained is $\frac{3}{4}$ of 1000 gallons or 750 gallons. Similarly, if the rainfall differs, the calculation may nevertheless be made. Thus, if the rainfall is 40 inches per year, this means an increase of $5 \cdot 35 = 1 \cdot 7$ over the 1000 gallons; that is, a total of 1143 gallons. If the plan area under roof and the rainfall both differ, the calculation may be made in two stages, allowing for the one variation and obtaining the daily average and then using this for the other variation. Thus, in the case where the plan area roofed is 0.3 acre and the annual rainfall is 40 inches, one adds 1·7 to 750 (= 857) or takes $\frac{3}{4}$ of 1143 (= 857). To change Imperial gallons to U. S. gallons, add 20 per cent to the number. Thus, 857 Imperial gallons = 1028 U. S. gallons.

Our industrial plants having use for soft water have perhaps not fully availed themselves of the possibilities of securing a good supply from the rains. In order to do so, two things should be considered and dealt with in adequate fashion: (1) the character of the roof and (2) the arrangement for storage.

The slate roof is the best or one of the best. Probably, there are certain varieties of tiling—glazed and the like—which may present surfaces unresponsive to the solvent power of the water that runs over them. Lead and galvanized roofs are scarcely to be looked on with favor where lead or zinc in the water in small proportions is going to be objectionable. Just what is permissible in a roof depends upon the service the water is to perform. Where concrete is unobjectionable, the roof may naturally be of concrete slabs or slabs made of Portland cement and sand.

The storage reservoirs will naturally be permitted to present only unobjectionable substances in their surfaces. Certain kinds of wood will come into consideration. Concrete and cement-mortar slabs are also possible for many cases, or a $\frac{1}{2}$ -inch cement-mortar coating. Then, the reservoir may be lined with slate, only it will be necessary to join the sheets with an innocuous mortar or cement.

Springs and wells, whether natural or artificial, are possible sources of supply for industrial works. An artesian well may be sunk in the yard or even inside a building. In general, water may thus be obtained in nearly all parts of the United States, so that a bored well

would appear to be a very popular source of water. However, the character of this water must be taken into consideration. More or less mineral matter is apt to be present. Usually, it will be present in the form of salts. The bases may be calcium, magnesium, sodium, potassium, aluminum and iron. These represent the solid substances encountered by the permeation of rain water through the strata of the earth. The bases may be met, in some cases, as simple substances or as components of more complicated chemical compounds. The water may be relatively pure as it encounters them or it may be carrying oxygen, carbon dioxide or other substances capable of assisting pure water in its solvent power. At any rate, water obtained from springs and wells contains salts of the foregoing basic substances. These salts may be carbonates, sulphates, chlorides, nitrates and silicates. Which salts of which bases will depend upon the conditions.

If calcium or magnesium are contained in the water, in the form of salts, then these salts tend to nullify the lathering qualities of soap. Such water is said to be *hard*. This is a very important matter in connection with dyeing or associated operations.

The water obtained from *rivers* and *smaller streams* is often a better water from one point of view than that obtained from a spring or a deep well. In the latter case, the considerable permeation of the soil and rock has given opportunity for the dissolving of various substances. In the case of river and stream water, a considerable part of it will be plain surface water, and since surface water frequently contains but little dissolved matter, its presence will tend to dilute the mineral salts coming from the contributory springs. However, river water frequently contains much suspended matter. The waters of the Mississippi River and the Missouri River are especially apt to be objectionable from this point of view.

Solid matter in suspension is ordinarily capable of removal either by sedimentation followed by decantation or siphoning, or else by filtration.

Calcium salts create the quality of hardness. In order to test a sample of water for calcium (lime), one may simply add a very little of a solution of ammonium oxalate and ammonium chloride. If a fine precipitate of a white color is at once formed, one concludes that some calcium salt or salts are present in the water.

Magnesium is also a base whose salts bring about hardness. The test is not quite so simple as for lime. However, one takes a sample of the water and adds a few drops of a solution of ammonium oxalate. The whole is now boiled and then filtered. The filtrate, which should be clear, is now evaporated until 9-10 of the volume has disappeared. The residue is allowed to cool down almost to room temperature, when a trifle of ammonia and sodium phosphate is added. It should now be possible, if magnesium is present, to secure a crystalline precipitate.

Iron may be easily diluted if present in considerable

quantity, and its absence may also be easily established. The sample is simply exposed to the air for several hours. If a reddish-brown deposit results, iron is probably present; if no deposit forms, iron is probably present either not at all or only in a relatively moderate amount. Where a small proportion of iron is suspected or considered possible, one evaporates the sample nearly to dryness, adding hydrochloric acid and a couple of drops of nitric acid. Potassium ferrocyanide is added or else potassium thiocyanate. If iron is present, a greenish-blue color will appear (in case the ferrocyanide was used) or a red (in case the thiocyanate was employed).

If a salt is present in the form of a *sulphate*, one may detect it by adding to the sample a few drops of hydrochloric acid and then a trifle of barium chloride, when a white precipitate will appear.

If the base is present in the form of a *chloride*, then the addition of a little nitric acid and a little silver nitrate may be expected to produce a white precipitate of a curdy character.

Bicarbonate and *free carbon dioxide* may be detected by the white precipitate consequent upon the addition of a little clear lime water. If, upon boiling a separate sample subsequently to the formation of a precipitate in the way described, another precipitate is formed, one concludes that the bicarbonates present are the bicarbonates of iron, lime or magnesia.

An *alkaline carbonate* may be expected to manifest its presence by the red coloring of a sample of water that has been boiled, filtered and had phenolphthalein added to it.

A *free acid* in water may be disclosed by the red color consequent upon the addition of a few drops of a neutral solution of lachmoid.

Organic matter may often be determined as present by evaporating a sample of the water to dryness in a porcelain or nickel evaporating and then heating the residue. The effect of the heat on organic matter will be to produce a brown and ultimately a black color.

The foregoing simple tests are to be regarded as having qualitative value only, and to be not always conclusive. They will, however, probably cover the more usual cases.

Industrial water for the purpose of this article may be divided into the following groups:

1. Water for steam.
2. Water for scouring.
3. Water for washing.
4. Water for bleaching.
5. Water for mordanting.
6. Water for dyeing.
7. Water for chemical manufacture.

8. Discharge water. This refers to the water discharged from the plant into some public stream. In some cases there will be no point in the management of the plant seeking to purify, or at least modify, the water thus discharged, for the reason that the stream does not have any relation to human beings. But

these cases must be few. Then there are plants whose discharge water is unobjectionable to all parties. But there are a multitude of cases where the water when it ceases to be of service to the plant is unfit to be discharged into a public stream or the like. Some kind of treatment is needed to correct or at least minimize whatever may be wrong. It would seem, then, that some account might well be given in a future instalment of some of the modern methods of dealing with factory waste water.

If absolutely pure water (H_2O) could be commercially obtained, then this water would suit all of the first seven items of the foregoing list. In practice a compromise has to be effected, and this compromise is not the same for all the enumerated purposes.

HARDNESS OF WATER

The *hardness* of water may be defined as the quality which resists the formation of a lather when soap is agitated in water. As this quality plays an important part on the water used in dyehouse and textile-mill operations, it will be necessary to consider it. Hardness has been subdivided into two varieties, *temporary* and *permanent*. Temporary hardness is that which is caused by the presence of a calcium or a magnesium bicarbonate. Permanent hardness is that which owes its existence chiefly to calcium or magnesium sulphate and chlorides. Technical people have sought to formulate methods for the estimation of the *degree of hardness*.

Helmer's method for determining the degree of temporary hardness is substantially as follows: Normal sulphuric acid is added to water in the proportions of 1 to 50 to form a weak solution of known strength. Into a test tube introduce 100 c.c. of the water to be tested. To this add several drops of methyl orange. This liquid is then titrated with the weak sulphuric acid solution until the orange color has disappeared and a red has taken its place. The degree of temporary hardness will be determined by the number of cubic centimeters of the weak sulphuric acid that are found to be necessary to the displacement of the orange color by the red. One cubic centimeter of the dilute acid will be required to neutralize 0.001 gram of calcium carbonate ($CaCO_3$). As the 100 c.c. of water weighs 100 grams, there will be in the test tube 100,000 parts if each part be 0.001 gram. The number of cubic centimeters of dilute acid added will accordingly mean the number of parts of calcium carbonate contained in 100,000 parts of water. Where it seems preferable, the acid may be diluted by using 1 part of normal acid in 10 parts of water. In this case it has been suggested that the increased strength of the dilute acid be offset by titrating 500 c.c. of water instead of 100. A similar procedure may be used for magnesium carbonate ($MgCO_3$).

The permanent hardness (which is usually dependent upon calcium or magnesium sulphate) may

be determined as follows: Similarly to what was done with the normal sulphuric acid in the preceding paragraph, an aqueous dilution of sodium carbonate in the proportions of 1 to 50 is prepared from the normal solution. A sample of the water to be tested, 100 c.c. in amount, is put into a platinum dish. To this sample is added a measured volume of the dilute sodium carbonate. The amount measured is to be considerably in excess of what is required. The dish, with its contents, is now put over a water bath and the solution evaporated to dryness. Attention is to be given lest the residue in the basin be overheated and some of the precipitated carbonates be converted into oxides. The residue in the dish is now dissolved in hot water and the solution filtered, and dish and filter washed. The filtrate, which contains the sodium carbonate, is now titrated with a 1 to 50 dilution of normal sulphuric acid. By this operation one determines the excess of sodium carbonate that was added. This result is to be subtracted from the *total* number of cubic centimeters of sodium carbonate that was added. The difference will be the number of cubic centimeters employed in eliminating the permanent hardness. As 1 c.c. of sodium carbonate solution equals 0.001 gram of calcium carbonate, formed from the sulphate, that was precipitated from 100 c.c. (= 100 grams) of water, it likewise stands for 1 part in 100,000 of water. The difference, consequently, gives the permanent hardness.

Another method for the determination of the hardness, known as Wanklyn's, is based on the precipitation of the calcium and magnesium salts in the sample by a standard soap solution. The degree of hardness of water is determined, by Wanklyn, by adding one to the number of grains of calcium carbonate in 1 gallon of water. As this gallon is presumably 1 Imperial gallon, it is equal to 1.2 to 10 pounds of water at 62 deg. Fahr.

First prepare a quantity of the standard soap solution. To do this, first dissolve 10 grams of pure white castile soap in 600 c.c. of 90 per cent alcohol, and bring the total volume up to 1 liter by adding distilled water. The soap solution thus prepared is approximately the strength wanted. This soap solution is then standardized by the following procedure: In 1,000 c.c. of water 1.11 grams of pure anhydrous calcium chloride is dissolved, or else 1 gram of pure calcium carbonate is dissolved in an excess of hydrochloric acid. A water bath is used in connection with drying either solution to dryness. The residue is to be dissolved in water and then evaporated to dryness. This residue is then dissolved in 1,000 c.c. of distilled water. This is the standardizing means.

To make a test one transfers 10 c.c. to a bottle provided with a stopper. This bottle should hold about 250 c.c. From the soap solution that is to be tested one secures a convenient quantity in a burette, and then proceeds to introduce 1 c.c. of it at a time into the bottle. The stopper is replaced and the contents

shaken after each addition. A lather will be formed which will be rather evanescent at first. But as more and more of the soap solution is added the lather becomes more and more permanent. When the soap solution is exactly right, 11 c.c. of it will produce a permanency of the lather that will last for five minutes when the bottle is laid on its side. It will be well, when adding from the burette, to add less than 1 c.c. at a time when the close of the operation is approached. If the soap solution is ascertained to be too strong, it may be diluted with equal volumes of alcohol and water until precisely the right strength is produced.

The *total hardness* (temporary plus permanent) is determined by titrating 70 c.c. of the water to be tested with the standard soap solution, prepared as directed above. The number of cubic centimeters of this solution that it is necessary to add in order to produce a permanent lather for five minutes gives us the basis for determining the degrees of total hardness. One is subtracted from the number of cubic centimeters added, and this gives the number of grains of calcium carbonate per Imperial gallon.

It is advised that if the sample requires more than 16 c.c. of the standard soap solution, or if a large amount of magnesia is present so that the requirement becomes less than 7 c.c., a smaller amount of water should be taken as a sample. The difference between it and 70 c.c. may be made up by adding distilled water.

To determine the permanent hardness, one may boil 500 c.c. of the water to be tested and hold it at the boil for half an hour. The object here is to secure the precipitation of the salts producing the temporary hardness. The loss by evaporation is replaced by distilled water that has been boiled recently. The liquid is now filtered and 70 c.c. of the filtrate is titrated with the soap solution after the manner already described. The permanent hardness is thus found. By subtracting it from the total hardness the temporary hardness may be ascertained.

The degrees of hardness do not mean the same thing everywhere.

1 deg. English equals CaCO_3 in 10 pounds of water.

1 deg. French equals 1 part CaCO_3 in 100,000 parts of water.

1 deg. German equals 1 part CaO in 100,000 parts of water.

These degrees have been equated. I append the following equations for converting any one into any other:

1 deg. English equals 0.80 deg. German or 1.43 deg. French.

1 deg. French equals 0.70 deg. English or 0.56 deg. German.

1 deg. German equals 1.25 deg. English or 1.79 deg. French.

(Concluded on page 27.)

Dyeing Garments Black

Formulas and Processes for Producing This Color on Wool and Cotton Unions, Silk, Cotton and Silk Unions, Cotton and Mixed Fabrics and Goods Composed of Wool and Silk

By JOSEPH LOEBL

BLACK ON WOOL AND COTTON UNIONS

THE simplest method to use when dyeing black on wool and cotton material is to dye with the so-called union dyes. Union Black is sold by all of the dyestuff dealers in various grades. A cheap dye will give the material a cheap appearance after the dyeing operation is completed, while a high grade dye will produce a high grade color. It is a fact that the dyestuff manufacturers' receipts to produce a certain color are not always correct. For example, the average receipt is as follows, the dyebath being made up with from five to six per cent of Union Black and twenty per cent of Glauber's salt:

Enter the goods at a temperature of 160 deg. Fahr. and give the cotton a chance to fill up. Gradually raise to the boil and boil for from thirty to forty minutes.

Material that is dyed in this manner will generally turn out unsatisfactory. In case a fresh dyebath is made from five to six per cent of the dyestuff will be insufficient. The wool might fill up properly when this amount of dyestuff is used but the cotton would appear hungry.

When the dyebath is made fresh at least eight per cent of the dyestuff is necessary to obtain a full black. Further, the boiling and the Glauber's salt is very likely to cause wrinkles which are almost impossible of removal in the finishing process. It is the better plan to commence to dyeing operation at a temperature of 190 deg. Fahr. and to keep the dyebath at this temperature for from one to two hours. Only half of the Glauber's salt should be added to the dyebath at the start and the other half after the bath has cooled down to about 160 deg. Fahr. If desired ten per cent of Glauber's salt may be added to the bath at the start and ten per cent of common salt added after the wool has filled up.

The wool takes the dye best at a temperature near the boiling point, while the cotton will fill up best at a temperature of from 140 to 160 deg. Fahr. It is not necessary to stir the goods until the whole lot is twisted up like a ball. The goods should be kept in motion only enough to keep them spread out. It is always of great assistance to produce an even color and a thorough penetration of the dyestuff to use a softener such as Monopol, Puropol or Brilliantine.

After the goods are dyed, drain and cool without rinsing. When the goods have cooled off they should be given the first rinse in a hand-warm bath containing from ten to twenty per cent of sal soda. The addition of the soda is absolutely necessary to develop the black to its deepest shade, strip the surplus dye from the material and prevent the goods being streaked. When the goods are taken from the first rinse they should be drained and

given two rinses in cold water to the last of which has been added a softener to brighten the color. After the last rinse extract the goods and dry them in a moderately heated room.

To secure good results by the one-bath method described above it is absolutely necessary that the material to be treated be free from acid.

The two-bath method is used for dyeing union goods that contain but little cotton, or in which the cotton is not so evident as the wool, and when no great fastness to washing is required. On the other hand shades can be obtained by the two-bath method that are faster to light than those produced by the one-bath process. The process is as follows:

Dye the wool with an acid dyestuff or a one-bath chrome dyestuff by the method described further along in this article, and wash thoroughly to remove the acid, using a small amount of soda or ammonia in the bath when permissible. When the wool has been dyed, top the cotton in a fresh, concentrated bath with a substantive dyestuff, adding from two to three pounds of Glauber's salt per one hundred gallons of liquor. This method of dyeing assures a bright and pure color.

Another method that may be used on material that is made up mostly of wool is to dye in a neutral bath using a neutral dyeing black, such as Neutral Wool Black G, or Surphur Cyanine Black, to which has been added a small quantity of direct black to cover the cotton. This method is preferred by many garment dyers because of the cheapness of the process.

It often happens that the garment dyer will receive for treatment a wool dress, or other garment, trimmed with cotton lace. In this case it is the better plan to dye the wool with an acid black. When the wool has been covered the garment should be rinsed well in a lukewarm bath, to which has been added a small amount of soda or borax to neutralize the acid. The cotton trimmings are then dyed with a cotton dye such as Direct Cotton Fast Black. About three per cent of soda or borax is added to the dyebath and the dyeing done at a temperature of 160 deg. Fahr. with the addition of ten per cent of common salt. The addition of the soda to the bath prevents the cotton color from going on the wool.

After the wool has been dyed with an acid color Union Black cannot be used for topping the cotton because a part of the Union dye would go onto the wool fiber and cause it to appear bronzy. A black must be used that dyes the cotton only. Dyes that answer this purpose very well are Cotton Black E Conc., Amanil Black G Extra, and Deep Black O.

BLACK ON SILK

In former years the dyeing of silk was the hardest problem that could be put up to the garment dyer because none of the aniline dyes filled the bill quite as well as logwood. A large majority of the silk mills are to-day using logwood for producing a black on their products. The garment dyer, however, cannot make use of the logwood process to advantage for the reason that considerable space and time are required to apply this natural coloring matter. Further, there are few dresses that are made up entirely of silk. Most of them have trimmings of one nature or another composed of cotton or artificial silk. In cases such as this very good results can be obtained with a good union black.

Dyeing with these colors is carried out with the bath at a boiling temperature but the bath should not boil. No additions to the dyebath are made. If satisfactory penetration is obtained a small amount of acetic acid may be added to exhaust the bath. Any excess of acid should be avoided.

When the goods are removed from the dyebath they should be rinsed in lukewarm water, to which has been added soda in the proportion of two pounds to each one hundred gallons of water. Shades obtained are classed as fair. A typical formula is as follows: Dye with from eight to ten per cent of Nacco Union Black and from one to two per cent of acetic acid after boiling. The goods should be rinsed in two cold waters, soaped cold and brightened after soaping in warm water containing either acetic acid or formic acid.

On account of the value of silk goods the utmost care should be taken with the dyeing process. It is advisable before dyeing to test the strength of the materials by rubbing. If the silk has been weakened in any manner or for any reason the quickest dyeing method must be resorted to and such colors must be used as will dye quickly and evenly. To promote evenness and penetration the dyeing should be done in a boiled-off soap bath, broken with acid. As garment dyers cannot obtain boiled off soap a substitute may be made by mixing one pound of olive soap, two and one-half ounces of gelatine and four gallons of water. One-third of one-fourth of the bath should consist of this soap solution. Also add slowly, and under constant stirring, from two to five per cent of sulphuric acid, or four per cent of formic acid. Bring the bath up to a lukewarm temperature, work the goods in this bath several times, take them out, add the well dissolved dyestuff, stir up the bath, add the goods and commence the dyeing operation. Slowly warm up the bath to about 180 or 190 degrees, work for one hour, then rinse in cold water and add acetic or formic acid. Soaping after the last rinse is not necessary. Some of the acid dyestuffs that meet the requirements very well or Naphthylamine Black 4B, Naphthyl Blue Black and Neutral Wood Black.

All of the above mentioned dyes produce a blue black. To obtain a jet black the dye must be shaded with a

suitable yellow or green. Dyestuffs that may be used for shading purposes are Indian Yellow R, Victoria Yellow, Metanil Yellow, Orange Extra, Acid Green Extra and Azo Flavine RS. For ten pounds of goods about one and one-half ounces of dyestuff should be used and two and one-half ounces of yellow.

The acid blacks on silk are fairly fast to light, but are not very fast to washing. The dyeings are rendered faster to washing by an after-treatment with sumac or acetate of alumina. The after-treatment causes the silk to become slightly softer.

BLACK ON COTTON AND SILK UNIONS

The dyer who would color a fabric composed of half silk and half cotton a full deep shade is up against a problem worthy of his best efforts. Direct colors are generally used for this work. The material is dyed for about an hour in a boiling hot bath containing three-fourths of an ounce of borax and from one-half to one pound of Glauber's salts to each ten gallons of water.

Half silk, such as satin, should never be boiled as in this case wrinkles develop and it is almost impossible to remove them. The silk will color best at a temperature very close to boiling while the cotton takes the dye best at a low temperature. Dioxine Black BH, Cotton Black and other dyes are suitable for this material.

The method mentioned above does not produce a color that is full and deep in shade and that is fast to washing. If a full, deep shade that is fast to washing is desired, resort must be had to one of the developing blacks. All dealers handle these dyes. The method of applying them should be obtained from the manufacturer or the dealer.

Splendid results are obtained by dyeing the material with a combination of Direct Black and logwood. Goods dyed in this manner will have deepest shade of black that can be obtained. When this process is used the material should first be mordanted with an iron liquor, such as nitrate of iron, at from 18 to 20 deg. Tw., rinsed, bottomed in a hot bath with from 2 to 5 per cent of fustic extract, and dyed at 180 deg. Fahr. in a fresh bath with from 4 to 5 per cent of Cotton Black E, ½ per cent of Chrysophenine, 10 per cent of logwood extract, 8 ounces of soap and ½ pound of Glauber's salt per 10 gallons of liquor. After dyeing for one hour the goods are lifted, rinsed well and scooped slightly with acetic acid.

This process is much more complicated than the developing process and can be used on all classes of half-silk goods; and while the color is not any better than that produced by the developing blacks it is just as good and the cost of the dyestuffs used is not as great.

BLACK ON COTTON AND MIXED FABRICS

There are several methods by which black may be dyed on silk and cotton mixed fabrics and the dyer should

use his judgment as to which one is the best suited to the particular work he has in hand. A good and a cheap method that is well suited for dyeing ribbons and linings that need not be fast is as follows: To each 10 gallons of the dye bath add $3\frac{1}{2}$ per cent, on the weight of the goods, of Union Black S, $3\frac{1}{2}$ per cent of Direct Jet Black, 1 per cent of Fast Yellow, one-third of an ounce of soda, 14 ounces of Glauber's salt and 6 ounces of soap. Dye in a short bath for one hour at a temperature of from 180 to 200 deg. Fahr., cool down for thirty minutes in the dyebath, rinse and dye in a second bath, acidulated with acetic acid, and at a temperature at 130 deg., containing $1\frac{1}{2}$ per cent Naphthol Blue Black and $1\frac{1}{2}$ per cent of Acid Green Extra Concentrated.

Another method is as follows: To each 10 gallons of liquor add 8 per cent of Cotton Deep Black, from 1 to 2 per cent of Glauber's salt crystals, three-fourths of an ounce of soda and from $1\frac{1}{2}$ to 3 ounces of soap. Dye for from 1 to 2 hours at a temperature just below the boil and in as short a bath as possible, allow to cool off somewhat after dyeing, rinse and dry.

A good, fast black is obtained by diazotizing and developing as follows: To each 10 gallons of the dye liquor add per cent of Diazine Black, 1 per cent of Direct Green CL, from 1 to 2 per cent of acetic acid and from 1 to 2 pounds of Glauber's salt. Dye for from 1 to 2 hours just below the boil and in as short a bath as possible. After dyeing allow the material to cool off somewhat and rinse it in cold water, and treat it in a fresh, cold bath charged with 3 per cent of nitrate and 9 per cent of hydrochloric acid. Finally, rinse thoroughly and develop for about 15 minutes in a cold bath charged for jet black with .7 per cent of Phenylene Direct dissolved with one-half its weight of soda. For a blue black develop with 1 per cent of Beta Naphthol dissolved with an equal weight of soda lye. Finally rinse and brighten in a hot soap bath with Methylene Blue.

A very deep black can be obtained by the following method: To each 10 gallons of dye liquor add from 1 to 2 pounds of Sulphur Black BB concentrated, from 1 to 2 pounds of sodium sulphide crystals, from 2 to 4 pounds of glucose, $1\frac{1}{2}$ ounces of soda ash, from 3 to $4\frac{1}{2}$ ounces of Turkey red oil, from 1 to 2 pounds of desiccated Glauber's salt and from $\frac{1}{2}$ to 1 per cent on the weight of the goods, of Alkali Blue R. Boil up the solution for from 10 to 15 minutes and then add it to the dyebath which has been previously heated to a temperature of from 160 to 180 degrees, and dye from 1 to $1\frac{1}{2}$ hours, squeeze off lightly, rinse at once in cold water containing some soda and again in warm water.

For dyeing subsequent lots the bath may be replenished with from 6 to 8 per cent of Immedial Black, from 6 to 8 per cent of sodium sulphide crystals, from 12 to 16 per cent of glucose, .1 per cent of soda ash, from 2 to 5 per cent of desiccated Glauber's salt, 1 per cent of Turkey red oil and from .5 to .7 per cent of Alkali Blue R. After rinsing treat the goods for from 15 to 30 minutes in a fresh, boiling hot bath charged with 2 per

cent of bichromate of potash, 2 per cent of sulphate of copper and 5 per cent of acetic acid. In order to bring the color to shade top with basic or acid dyes, or, if desired with logwood.

The topping with basic colors is done in a fresh bath heated to a temperature of from 140 to 160 deg. Fahr. and acidulated with acetic acid. New Methylene Blue N and R, New Blue R and B, Bismarck Brown FF and Safranine S are some of the colors suitable for topping purposes. Acid colors suitable for this work are Naphthylamine Black 4B, and B6. Acid Green Extra Conc., Indian Yellow G and R. The dyeing is done in a boiling bath acidulated with acetic or sulphuric acid.

For very deep black it is advisable to top with logwood or fustic which may be added to the boiling soap bath or to a bath acidulated with acetic acid. After dyeing brighten the colors in a bath charged with 3 ounces of acetic acid and 8 ounces of acetate of soda per 10 gallons of liquor, and dry. It is advantageous to add to the finishing liquor from 3 to 4 ounces of acetate of soda for each 10 gallons. This recipe gives a very deep, jet black.

BLACK ON GOODS OF WOOL AND SILK

Material composed of wool and silk is generally of a very delicate nature and must be carefully handled as any rubbing or pressing is very sure to leave marks. When cleaning this class of goods previous to dyeing it is the better plan to use weak soap baths at a temperature not higher than the hand can bear. Union dyes do not give full shades on wool and silk unions. The best way to dye this class of goods is in an acid bath. However, in the case of tightly woven material it is sometimes difficult to secure good penetration with these dyes. In this case it is the better plan to use direct dyes which have the property of dyeing the wool and the silk to the same shade. Nacco Black, Amanil Black and Union Black S are these dyes which may be used.

When dyeing in an acid bath only such dyes should be considered as go onto the fiber in a weakly acid bath. Some of these dyestuffs are the Neutral Wool Blacks, the Naphthylamine Blacks, the Alizarine Blacks and the Gloria Blacks. Dyeing with an acid black is carried out by preparing the bath with 10 per cent of Glauber's salt and 5 per cent of acetic acid, or with 15 per cent of Glauber's salt and 3 per cent of formic acid. The goods are entered into the dyebath at a temperature of 140 deg. Fahr., and the bath gradually raised to the boil. The material is boiled for not more than 20 minutes after which time the steam is shut off and the bath is cooled down to 120 deg. Fahr.

The wool has more affinity for the dyestuff than the silk has and will assume a deeper color during the boiling, while the silk will take on more dye at the lower temperatures and when more acid is added to the dyebath. To obtain a full shade on both fibers it is best to commence the dyeing operation with about one-half of the

amount of acid and to add the other half after the steam has been shut off and the bath has commenced to cool down.

Deep blacks may be obtained by using the following proportions of dyestuffs: Six per cent of Naphthylamine Black 4B, .25 per cent of Acid Green Concentrated, and

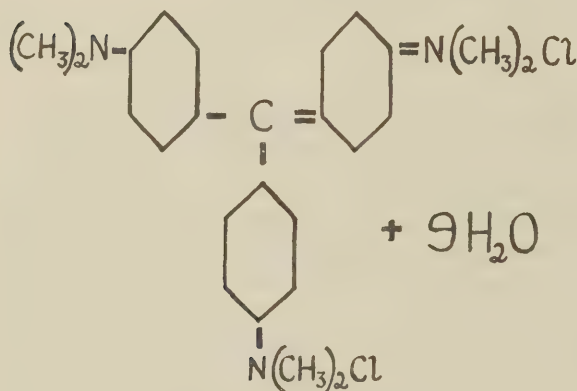
.5 per cent of Metanil Yellow; .8 per cent of Neutral Wool Black and .25 per cent of Indian Yellow; .10 per cent of Gloria Black.

Another method is to commence the dyeing without any acid and to add it when the dyeing has been in process for about 30 minutes.—*National Cleaner & Dyer*.

Practical Methods for the Preparation of Crystal Violet B

Translated from Dr. Gustave Schultz's 1914 Edition of "Farbstofftabellen" by Gustave Drobegg

CRYSTAL VIOLET B
Chloride of Hexamethyl-p-rosanilin
(Hexamethyldiamidofuchsammonium Chloride)
(Hexamethyl Violet) $C_{25}H_{30}N_3Cl$
or, $C_{25}H_{30}N_3Cl + 9H_2O$



METHODS OF PROCESS

1. Action of dimethylaniline upon tetramethyldiamidobenzophenone chloride.—*Germ. Pat.* 26016-27789.
2. Direct action of phosgene upon dimethylaniline in the presence of zinc chloride.—*Germ. Pat.* 29943.
3. Condensation of tetramethyldiamidobenzhydrol with dimethylaniline, and oxidation of the produced leucobase.—*Germ. Pat.* 29032.

DESCRIPTION OF PROCESS 1 (G. P. 27789)

In an enamelled vessel, fitted with agitator, steam and cold water jacket and distilling top, heat mixture of 10 parts of powdered tetramethyldiamidobenzophenone (Michler's ketone) with 20 parts of dimethylaniline till all is dissolved, and let cool under agitation; then add 6 parts of phosphorous trichloride. Reaction starts immediately, temperature rises and mixture turns intensely blue and its consistency changes to a thin liquid. After a short while, crystallization commences, while increasing temperature must be checked by cooling (cold water

jacket) to moderate degree, the whole mixture finally solidifying into a metallic-green mass of crystalline methylviolet. After several hours the product is dissolved in hot water, slightly oversaturated with caustic soda, and excess of dimethylaniline distilled off with live steam. The remaining color base is separated from the alkaline water and dissolved in the calculated amount of dilute HCl to form the neutral chloride, under the application of heat. The hot solution is filtered to separate it from any unchanged Michler's ketone, and salted out, the resulting product becoming more crystalline on cooling. Repeated crystallization yields the product in well-formed crystals.

DESCRIPTION OF PROCESS 2 (G. P. 29943)

Eighteen to twenty parts of phosgene are added to 100 parts of dimethylaniline in moderate current at a temperature of 20 deg. Cent. After twenty-four hours, fifty additional parts of dimethylaniline and 30 parts of powdered zinc chloride are added under constant agitation and at a temperature of 45-50 deg. Cent. Phosgene is then again introduced until the total weight has increased 20 parts; then the reaction is completed by continuing the heating to 50 deg. Cent. for 6 more hours under agitation. The product is slightly supersaturated with caustic soda, steam-distilled to blow over excess of dimethylaniline, and the remaining color base transformed into the sulphate. From the hot aqueous solution, the addition of salt yields well-developed crystals of the Chloride of Violet.

DESCRIPTION OF PROCESS 3 (G. P. 29032)

The first step is the formation of tetramethyldiamidophenylmethane by boiling in a reflux for five to six hours a mixture of 26 parts dimethylaniline, 9 parts formaldehyde (40 per cent) and 30 parts of hydrochloric acid of Sp. Gr. 1.19 (Ullmann). The excess of dimethylaniline is distilled off after supersaturation with caustic soda; the oily residue solidifies upon cooling and is purified by crystallization from dilute alcohol, yielding white crystal-

scales of melting point 90-91 deg. Cent. The yield is 18-20 parts. From this base the tetramethyldiamidobenzhydrol is made by oxidation with lead peroxide and HCl as follows: (Ullman) (1 mol.) 12.7 tetramethyldiamidodiphenylmethane are dissolved in HCl Sp. Gr. 1.18, 10.0 (2 mol.); the solution is poured into a mixture of 500 water, 15 (by vol.) glacial acetic acid, and 500 ice. This is stirred constantly at 0 deg. Cent., while being oxidized with a thin paste of lead peroxide 12.0 (1 mol.) The liquid will turn intensely blue. After some time the lead chloride in solution is precipitated with an aqueous solution of sulphate of soda 16.1; filter off sulphate of lead, and neutralize, while cold, with caustic soda. At this moment the separation of Hydrol takes place, first in the form of oily drops—then crystalline. Recrystallized from ligroin, it is obtained in crystals of M.P. 96 deg. Cent.

CRYSTAL VIOLET (5B, BLUISH)

The process is carried out as follows: Tetramethyldiamidobenzhydrol 8.1 mixed with dimethylaniline 4.5 and glacial acetic acid (20 cc.) are warmed on water-bath

and 20 cc. water added gradually. After one hour additional 20 cc. water are added and heating continued for 2 hours. At this time the hexamethyltriamidotriphenylmethane has separated in large scales. Filter and wash on suction filter; yield 10.1. Recrystallized from ligroin-benzol, the base is obtained in colorless scales, of M.P. 173 deg. Cen. To transform this base into the color, 1 mol. of it is dissolved in 3 mol. HCl diluted with water, then mixed with 100 times its weight of ice water, 2 mol. glacial acetic acid added, and at 0 deg. Cent. oxidized with a thin paste of lead peroxide, corresponding to PbO_2 . The lead in solution is precipitated with sulphate of soda; the separation of color which then commences is avoided by heating, and after filtering, the crystal violet is salted out with NaCl, whereupon it crystallizes in large, well-developed needles. Yield, 90 to 95 per cent (Ullmann, G. P. 27032).

ANOTHER METHOD

Another method of preparing crystal violet is (G. P. 61815): Condensation of dimethylaniline with formiates of polyvalent alcohol of high boiling point.

Concrete Construction for Modern Knitting Mills

With Special Reference to Dyeing and Finishing

Address Before National Association of Hosiery and Underwear Manufacturers by W. H. Rose, of Lockwood, Green & Co.

ALL industry becomes more exacting as it develops. Among other things, it requires better plants than were formerly found necessary. In no other industry has this need for better plants been more pronounced than in the knit goods industry. The public demands a better article than it did in past years, and factories must be designed to meet the demand for better goods in larger quantities.

A modern knitting mill should be thought out in advance, before any actual construction begins or machinery is purchased. Before the land is bought for a new plant, if practicable, outlines of departments and buildings should be made and machinery layouts determined to insure economical routing and handling of materials.

It is important that the buildings should lie on the ground correctly, at a proper elevation, with best arrangements for drainage, railway sidings, light, etc. It seems almost trite to mention those and many of the things I shall say this morning, yet in a large number of plants such considerations have evidently been ignored. Very frequently a mill executive will buy his land first, sometimes order his machinery, and occasionally even build his building without first thinking his scheme through to the end.

In addition to the studies of layouts previously mentioned, a modern knitting mill must be planned with particular attention to light, both natural and artificial. Good lighting is demanded by operators, and pays from an operating standpoint. Improvement in lamps and distribution of light are among the notable developments in engineering in the past few years.

A modern plant should be adequately equipped against fire loss. It should be structurally modern, rigid and strong, with wide column spacing, high ceiling and sufficient exits. Care must be given to sanitation and to the comfort of employees. The time is past when operatives can be crowded into badly lighted, poorly ventilated rooms. The modern knitting mill is bright, attractive, clean. A little attention and often very slight additional expense will give a pleasing general appearance which not only attracts help and is good publicity, but is a genuine delight to the owner.

The last few years have shown a marked tendency to go to the use of reinforced concrete construction for knit goods plants. The advantages of this type of construction are almost too well known to require mentioning here. Among these advantages, of course, are more permanent construction, smaller mainte-

nance charges, lower insurance rates, increased daylight, greater stiffness and rigidity, which carries with it the possibilities of placing heavy machinery and even a dyehouse on upper floors. There is also a marked tendency at the present time to go to the use of much wider buildings than were formerly thought possible.

Knitting mills constructed a few years ago were thought to be as wide as practical when constructed in widths of 50 to 60 feet.. Modern knitting mills, however, are readily constructed with widths of 85, 90 and even 100 feet, and, by the use of thoroughly modern methods, are made even lighter at the center, for the use of machinery, than was the case of the narrow mills which were formerly used.

In the construction of mills for the manufacture of full-fashioned hosiery, the earlier mills were usually built of slow-burning or mill construction, and were usually constructed of a width suitable to take one row of machinery set crosswise of the building, giving an over-all width of 42 to 45 feet. Also in these earlier mills, on account of heavy machinery and the vibration from it, the usual arrangement was to put these machines in the lower stories. Modern methods of construction make it easily possible to construct these mills of sufficient width to take a double row of machines, which require an over-all width of 85 to 90 feet. The use of concrete construction, with its added stiffness, makes it possible to consider the placing of full-fashioned hosiery machinery on the fifth, sixth or seventh floors, as the occasion may require, without particular regard for the question of vibration.

DYEHOUSE ON TOP FLOOR

The use of concrete has also made it possible to consider in many cases what seems to be a logical provision for the location of the dyehouse or washing and bleaching department on the top floor. Until very recently this has not been considered a practical thing in a mill-constructed building, although we have known of an instance where a dyehouse was installed on the fourth floor of a mill-constructed building, with subsequent processes located in the lower floors. In this case the joints of the floor were caulked in very much the same manner as the seams of a boat. We would not recommend this general method, however, as a regular practice, to place the dyehouse in the upper floor in a mill-constructed building, but in concrete this not only becomes relatively simple but also, for reasons of arrangement and routing, becomes a desirable thing to do.

IMPORTANCE OF PRELIMINARY PLANS

In the manufacture of hosiery and underwear, as in most other lines to-day, manufacturers are becoming alive to the possibilities of improved production through most careful study and proper consideration

of their problem before new-building layouts are made and studied; and while it is not uncommon to-day for new knitting mills to be entirely laid out in every detail, with all departments and machines located before construction is started, this is a situation which has come up very recently and would not have been thought necessary a few years ago.

To-day the manufacturer who would erect a building without a very definite idea of how he would use each and every floor, and where the departments would be located, would be considered lacking in foresight.

ROUTING AND RELATIVE ARRANGEMENTS OF DEPARTMENTS

There is nothing particularly complicated about the arrangement of departments in a knitting mill, and, given a complete new plant to consider, it becomes a very simple matter to arrange departments properly and to have the routing so that the minimum amount of traveling will be required for the goods. When, however, the problem, as is more often the case, becomes one of extending an old plant and enlarging all the departments, with some to be located in a new building and some to remain in the old building, then the situation requires much more careful study, and it is in these cases that the proper amount of study will promise the greatest possible return on such an investment of time given to making preliminary play-outs.

Most knit goods plants start manufacturing processes with the delivery of the yarn to the winding and knitting departments. In a few instances, which are, however, in the minority, knitting plants have their own yarn mills. In these cases, however, they are usually located in separate buildings, and so the layout of the knitting mill in these cases becomes almost exactly the same kind of problem as when the manufacturer buys his yarn.

The work of the average knitting mill leaves off when the finished goods are loaded out of the shipping room, and therefore it is easy to see that the arrangement of an ideal knitting plant would be one in which the yarn on receipt at the plant would be taken to the top floor for winding and knitting, and then carried on through the subsequent processes, traveling down from floor to floor in its progress through the mill, and finally landing on the ground floor, where finished goods, storage, packing and shipping could be located. Several modern knitting mills have been laid out on this basis and a good example of such a mill is the underwear mill of the Black Cat Textile Company, at Bennington, Vt.

LOCATION OF DYEHOUSE

As the work of the dyehouse in the knitting mill usually follows closely after the knitting processes

and is followed by many finishing processes, it will be seen that the arrangement above referred to will necessarily bring the dyehouse to or near the top of the mill, and if the mill is properly constructed of reinforced concrete this becomes easily possible and will be discussed further under detailed requirements for dyehouses.

The machinery used in knitting mills is in the form of relatively small light machines which are capable of arrangement in almost any kind of space, but here again it is of advantage to study the proper column spacing so that the layouts may be made in the several departments with minimum interference of columns and maximum economy of arrangement. Generally speaking, it will be found proper to locate practically all the machines in rows running crosswise of the mill. In this way operatives receive the best light; and, furthermore, in this method it is possible to have the main trucking alley at the center of the room, which is the space farthest from the windows, and which naturally is the space which best serves the total floor area from a trucking standpoint.

SPECIAL DYEHOUSE REQUIREMENTS

There are a few fundamental requirements for a dyehouse which are of the utmost importance. These can be briefly stated as good daylight, proper ventilation, good drainage and convenience of location to other departments.

Mills which have dyehouses meeting all of these requirements are few and far between. Practically all old mills have dyehouses located on the ground floor or in the basement. Naturally most of these do not have good daylight, many of them have no ventilation; the drainage is usually inadequate and in practically all cases these dyehouse locations involve a great amount of elevator service to get goods to and from other departments.

The location of a dyehouse in its proper place in sequence of operations, whether this be on the top floor or on next to the top floor, as the conditions may require, will eliminate much unnecessary handling of the product and will in practically all cases not only pay a large return on any investment required to get this location but will also give many other advantages.

PROPER LIGHTING

The question of proper daylight in the dyehouse for washing and bleaching departments is easily solved by the construction of modern concrete buildings, and in the case of the top-floor location overhead light becomes easily available, so that this is very easy to take care of.

VENTILATION

The question of proper ventilation of the dyehouse

is one which has received much consideration and has been the subject of study and experiment on the part of manufacturers and engineers. It has now become an accepted fact that in order properly to ventilate a dyehouse two things must be provided: First, an adequate supply of warm dry air must be blown into the dyehouse and an equal amount of saturated air must be removed from the room. Natural drafts must not be relied upon to produce either of these results, and in order to secure the best effect it is necessary that fans be used for both incoming and outgoing air.

There are many possibilities in the way of locating these fans, with their supply and exhaust ducts. Naturally, the more rapidly the air change is made the more completely are the steam and vapor removed from the building. In summer, due to the use of large quantities of hot water and steam, the dyehouse becomes a very warm place in which to work, and at such periods of the year very adequate exhaust systems are desirable in order that maximum cooling effect may be obtained. The question of prevention of condensation on walls and ceilings goes hand in hand with the question of ventilation, and will often require special treatment, especially in climates where long cold winters are the rule.

DRAINAGE

Under the heading of drainage, the requirements in this case are quick and positive drainage of floors which is of the greatest importance; water and waste liquors must not be allowed to stand around in pools on the floor; the discharge from vats and tubes should be piped directly to the sewer and not be allowed to discharge openly on the floor or into gutters, because of the large amount of additional steam and heat which is produced by this method.

In a concrete building it is necessary that the floors be covered with a special waterproof coating, as concrete alone is not sufficient guarantee of a tight floor. This presents no special difficulties. A desirable method of handling this construction is to have a working floor located a short distance above the concrete floor. This working floor is constructed of plank with open joints. This gives operatives a dry floor on which to work, and also obviates the necessity for setting machines in pits.

LABORATORY AND DRUG ROOM

The modern dyehouse has, of course, a drug storage room and a dyer's office and laboratory in connection therewith. These should be arranged opening directly into the dyehouse, and it goes almost without saying that the dyehouse of a modern knitting mill should be located as closely as possible to the point where the goods which are to be dyed or washed are to be produced, and when the goods leave the dyehouse they should go directly by the shortest route to

the dry room, which should be located close to or adjoining the dyehouse.

POWER TRANSMISSION AND ELECTRIC DRIVE

The use of long lines of shafting is now practically obsolete for knitting mills, and in most modern hosiery and underwear mills machines are driven in small groups by motors located on either floor or ceiling. In the case of machines with floor shafts, the best practice is to drive each line of shaft with a single motor with chain drive, so that motors may set directly under the tables, out of the way. Individual motor drives are being supplied to the larger machines, and in many cases to individual dyeing machines, all apparently with entirely satisfactory results, with the possible exception of underwear knitting machinery of certain types, while we understand that better results have been found by driving in relatively small groups.

LIGHTING THE MILL

The past few years have shown great strides by the manufacturers of lighting equipment, such as shades, lamps and reflectors; and the average knitting mill, if it has not a modern lighting system, could well afford to consider entirely going over and modernizing the lighting layouts and equipment. Indirect lighting has been used to a great extent lately in hosiery mills, and a soft uniform light obtained by this method has proven very satisfactory. There remain, however, some departments where the application of this does not seem to give the most satisfactory results, such as in boarding rooms and some special departments.

HEATING AND VENTILATING

In modern knitting mills the subject of proper heating and ventilating is receiving much more consideration than formerly and the best method is the use of a combined system of heating and ventilating with a central station where all air is properly conditioned before being blown into the room. It is desirable to have this supplemented in the form of modern cast-iron wall radiators for the windows, and, by all means, a system of automatic temperature control, with thermostats located in every room. It is hopeless to expect that uniform temperatures may be obtained in workrooms by having a man go around and open and shut valves by hand.

SERVICE EQUIPMENT

It is hardly necessary to speak here of the very great improvements which have been made in all manufacturing plants in the way of provisions for the comfort and welfare of the employees. These take the form of lunchrooms, rest-rooms, hospitals, the best

toilet and wash room facilities, schools for the training of employees, etc.; and while these offer no particularly difficult or technical problems for the designers of modern mills, they are features which must be kept in mind in order that proper space may be provided for them at the location where needed and where they will be conveniently located for use of the employees.

POWER PLANTS

The power-plant problem at the average knitting mill is not one as a rule requiring the generation of large quantities of power, and many manufacturers may think they can well afford to purchase the small amount needed. However, the small plants almost invariably require the use of a considerable amount of steam, not only for the heating of buildings in winter but also for the operation during all seasons of the year of the dyehouse, requiring large quantities of hot water, and also the operation of dryers, which at all times take a large quantity of steam. Having these requirements in mind, it will be seen that the average knitting mill should generally arrange to generate its own power, so that exhaust steam from engines may be fully utilized in the heating of water and in the operation of dryers. Under these conditions the average knitting mill can usually make power at a cost well below the cost at which any central station could afford to sell the same amount of power.

WATER STORAGE FOR DYEHOUSES

The question is usually raised as to whether the location of dyehouses in the upper story of the plant will not greatly block the provision of a suitable supply of water for this department. This may be answered by saying that if this is the case, it is necessary to provide an enclosed tank located on the roof of such a building, containing as a rule two storage tanks, one for hot water and one for cold.

Concrete construction makes it comparatively simple to carry these heavy loads at the roof level. The use of ample storage tanks at this point makes it possible to use very small pumps for keeping the water supplied to them; in many cases the city or plant pressure will keep these tanks filled through a relatively small line. Also, in such cases a water heater located at a lower level in or near the power house may be utilized for providing a circulating system whereby the hot water in the storage tank is being continually recirculated through this heater, into which all exhaust steam from the engines may be exhausted.

The problems met with in the design of modern knitting mills do not differ greatly from those met with in other industries, and require, generally speaking, a knowledge of the work to be done in such plants, a familiarity with the best plants of the country and what they are doing, and the application of sound en-

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AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY

PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL

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AN EXPLANATION

(Which Our Friends Will Help Us by Reading
Carefully)

Four weeks ago, in the editorial columns of the AMERICAN DYESTUFF REPORTER, the announcement was made that its publishers, in response to advice from every quarter of the field, had determined to issue a Monthly Supplement to be devoted exclusively to the use and application of dyestuffs and the mechanical equipment incidental thereto. That determination has now reached its maturity and is about to bear fruit. The reader must be cautioned plainly, therefore, here and now, that *he does not hold in his hand the first issue of that proposed monthly*.

The foregoing statement needs explanation. It is true that this issue is the first to make its appearance. Nevertheless, one year from next month will mark, in the minds of the publishers, the first real anniversary of the production of the AMERICAN DYESTUFF REPORTER Monthly Technical Supplement. The present issue bears exactly the same relation to the publication which is about to be produced as a skeleton bears to the human body, or the structure of steel girders bears to the finished building. The framework is there; the general form and the dimensions are indicated, but the solid, vital substance—the meat, if you will, or the bricks, concrete and woodwork which constitute the true embodiment of the building—has not as yet been filled in. The time has been too short for the immediate consummation of an ambitious plan.

We ask that our subscribers and other friends will not, therefore, base their estimate of future issues upon the contents of the present number. Scarcely a more unpropitious moment could have been selected in which to launch an enterprise of this description. It had been

hoped that the first appearance of the new journal would take place after its producers were organized to give the very best of which they were capable. But this was not to be. A combination of circumstances rendered it advisable to go ahead with the machinery of production scarcely determined upon, let alone perfected, and with the proverbial thousand and one details attendant upon the inauguration of a new journal in a most chaotic state. Small wonder, then, that there has been no time for the gathering of such original contributions as we are going to furnish, nor the opportunity for any great amount of work among potential advertisers. Small wonder, then, with the present temporary slack period which is noticeable to some extent in both the dye and textile industries to contend with, and thoughts of present, past or future vacations uppermost in the minds of many that the sudden invitation to take an interest in a new project, all unproved, should not have at once met with that tangible response the materialization of which during the next few weeks has been sincerely and widely promised.

Many of our friends have asked us why we did not wait until completely ready before bringing out an issue. The answer can be found in the statement of a principle, familiar to publishers, not so familiar to readers. It is this: We should never have been "completely ready" until after the first issue had been brought out. The longer the publication of the initial number was delayed, the longer would many prospective contributors and advertisers have delayed. It is almost always so with "first issues." A large number of future supporters of this or any other publication want to have something concrete placed in their possession—something they can see and handle—before taking definite action. And at the sacrifice of our own idea of fitness—which we rely upon this explanation to salve (using the verb in both senses)—we defer to this characteristically human trait.

The September number, then, will be our "first issue," not the present. It is the publishers' plan to produce a special number for the Chemical Exposition next month; hence, to pave the way it was thought necessary and desirable to bring out an issue which should give an adequate impression of its form and general character, even though it did not give much of an indication of its future contents.

To old and new readers of *The Reporter* we beg to emphasize the fact that the two publications, the weekly and the monthly, while allied in name and source, will be wholly separate in purpose and scope. The former was designed to be, generally speaking, first and last a newspaper, dealing—often in a rather more picturesque fashion than would be fitting in a strictly technical publication—with the broader aspects of the American dye industry, such as politics, news and recent developments of moment to the trade. It was and is, moreover, intended as an organ to fight adverse propaganda with every means at its command while at the same time initiating favorable propaganda of its own, based on the true

facts in the case of the dye industry. Its diminutive size, enabling the reader to carry it in his pocket when a more bulky publication might be left on his desk, together with its frequency of issue, are part of a deliberate scheme to render it a more effective weapon and flexible news medium.

The monthly publication, on the other hand, will fulfill all the obligations resting upon a technical journal of the first rank, except that its dominant aim will be the consideration of problems of strictly practical rather than of purely academic interest. We have no patience with the type of individual—and some can still be found—who hold that frequent excursions into the realm of pure chemistry are unnecessary and a waste of time, but investigation has confirmed the continued existence of so wide a gap in the published service to the other field that there one well may pause in the knowledge that the lifetime of a publication would not suffice to completely fill that gap, which is ever being extended as further progress is made. Hence, discussion of the wholly theoretical problems will be left largely to others.

The fields of the two publications being thus defined, it can be seen that there is no longer the necessity for even a pretense of mixing them. Each will hold to its appointed task, and it is believed that with the monthly to act as a medium for the dissemination of new contributions to the literature on coloring materials and their practical application, and as a forum for the discussion of new problems in applied dyeing; and with the weekly to keep the industry well posted on news which would often become ancient history if obliged to wait a month for publication, and on fresh political developments—with this combination, it is believed, a genuine service to the industry can be rendered.

We shall have more to say concerning the scope of this new journal in the September number. For the present we ask only the continued faith and good will of our old and new friends. The confidence that we shall not ask in vain is strengthened by the recent receipt of a letter from an individual, not altogether unknown to the industry, whose opinion carries sufficient weight to make his kind words a very valued tribute. We trust that we violate no confidence when we quote him as follows: ". . . and I have sufficient faith in the future of this particular publication to have agreed to co-operate with the publishers as advisory editor."

The writer of the foregoing will begin his active co-operation in time to assist in the preparation of the September number, and his name heads the article immediately following.

PROFESSOR OLNEY

With the best intentions and the most genuine sincerity of purpose in the world applied to any undertaking, these attributes are at best no more than half the equipment necessary to bring about the successful accomplishment of one's aims. To be sure, they are indispensable; without them no degree of gift, talent or training can prevail.

But what, for example, can an earnest desire to relieve human suffering achieve unless it be expressed through the special skill of the physician or nurse? He who would build great bridges to facilitate commerce must first undergo some real drudgery in order to find out the way. The intention is the motive force; the "knowing how" is the machine which transforms that force into effective action.

It is for this reason that The REPORTER counts itself and its readers more than fortunate in having won the consent of Louis A. Olney, professor of chemistry and dyeing at the Lowell Textile School, to act as the arbiter and guiding influence in the production of this monthly technical journal.

At the very outset it cannot be stated too emphatically that as we speak of Professor Olney's connection with this publication, we are speaking in the future tense. The reasons are fully explained in the announcement which immediately precedes this one. His name appears at the head of the present issue, but it has been placed there with precisely the same feelings and intent with which the reader might offer a business card bearing the name of his house before opening the negotiations which are to follow; it has been placed there as an effective means of announcing, to the industry at large, Professor Olney's approaching activities in behalf of The REPORTER. We desire to avoid above all things the impression that it was he who planned and carried out this number, particularly as even the publishers themselves are far from presenting it as an example of their purpose and abilities.

To the world which this publication will endeavor to serve, Professor Olney needs no introduction. Nor do his contributions to the advancement of the textile industry in this country require any words from us to enhance them. His standing is the result of definite service and a sane, well-regulated vision which has enabled him to anticipate the steady development which has marked the progress of the industry, and to prepare himself and others for it. His ability to direct and aid us in the accomplishment of our plans is drawn from an experience with the practical side of the textile industry such as is not the portion of everyone, and a grasp of the real needs of the industry which can only grow out of such experience.

Since, however, we are herewith drawing the attention of our readers to our good fortune, it is felt that a brief outline of that experience and varied affiliations will not be out of place.

Professor Olney is a graduate of Lehigh University, Class of 1896. Upon graduation he became an instructor in Brown University, where he instituted a course in textile chemistry. While at Brown he was interested in the study of dyeing and bleaching processes in a number of the textile establishments in the vicinity of Providence, and when the Lowell Textile School was established he was called to inaugurate the Department of Chemistry and Dyeing, which he has been in charge of ever since. In 1908 he became interested in the Stirling Mills, of

Lowell, manufacturers of woolen goods, and has been president of that corporation since 1911.

During the past twenty years he has been in close touch with the mills of Lowell and Lawrence, and a consultant and adviser to many. He is a member of the Institute of Chemical Engineers; the American Chemical Society, in which he has held various offices, and is a Fellow of the Association for the Advancement of Science. He is also a member of the Society of Dyers and Colourists, and of the Society of Chemical Industry, of England. In addition, since its inauguration in 1912, he has been an associate editor of *Chemical Abstracts* in charge of the section devoted to textile chemistry and dyes.

The REPORTER regards Professor Olney's approaching leadership as a guarantee of that constructive brand of service which it is its paramount desire to offer, and in the name of its readers, the true gainers, extends to him hearty greetings and best wishes for the coming work.

TECHNICAL TEXTILE EDUCATION: THE OPEN DOOR TO OPPORTUNITY

As the end of the summer approaches, many of the young men who graduated from the high schools and academies of the country in June are still undecided as to whether they will continue their education or enter directly into some business or manufacturing enterprise.

In either case, the call of the textile industry is attractive, and this is particularly true of the bleaching, coloring and finishing branches.

In the early days of the textile industry, the only avenues of approach were through the favor of some friend well established in the business, or—what was less likely—the demonstration of ability after a number of years of service.

Since the establishment of textile schools, the whole situation has gradually changed. Mill owners all over the country are beginning to realize the value of technical education for their managers, and the managers, on the other hand, for their superintendents and overseers. With the keen competition which existed before the war and which is soon to exist again, mill men are at last convinced that it is better by far, in the long run, to hire the right young man than it is to temporarily gratify a friend.

This is strikingly demonstrated by the fact that at one of the leading textile schools of the country, the calls for graduates during the past two or three years have been about three to every man available, and it is the regrettable truth that many excellent opportunities for some young man have, perhaps, been rejected with the reply: "No one to recommend."

As time goes on, an ever increasing number of technically trained men will occupy the executive positions, and, having the authority, will in most cases insist upon having similarly trained men if they can be secured.

The necessity of technical textile education for young men intending to enter the textile industry is, therefore, apparent, and this applies equally to the dyestuff industry, for the demand in the past for textile school graduates

by dye manufacturers and merchants has been even greater than by the textile industry.

To those who still give undue emphasis to the opportunities of the so-called "self-made" or "rule-of-thumb" man, as compared to those of the technically trained man, the following illustration drawn from more than twenty years' observation will, we think, express in a general way the relative status of the two:

Two young men, whom we will designate as A and B, graduate from the same high school at the same time, and possess as nearly as is possible the same intelligence and capability. A at once enters a progressive textile manufacturing plant, and B at the same time enters one of the leading textile schools, where he can secure a thorough technical textile education. At the end of four years B graduates and is engaged by the manager of the plant in which A has been working the same length of time. During the first month, and the first year—or perhaps even two years—A, because of his extensively practical experience, may be of greater value to the plant than B. But observation has shown that in a large proportion of such cases, after about three years B has risen to a position where he is issuing orders to A, and ten years from the time they both graduated from high school, B has outstripped A as to ability, grade of position, and salary.

It should be fairly obvious from the foregoing that young men still undecided as to their future would do well to consider the possibilities of a technical textile education.

PLAN TO ATTEND THE CHEMICAL EXPOSITION—AND VISIT THE "REPORTER" BOOTH

Plans for the Sixth National Exposition of Chemical Industries, to be held next month at the Grand Central Palace, New York City, indicate clearly that the event this year will break records in more ways than in the number of exhibitors. This mark, indeed, went by the board some time ago, and the managers continue to receive application for space daily. Last year, at Chicago, the list of exhibits reached its highest level up to that time, when they totaled 351. Several weeks ago the number of 1920 exhibitors stood at 370. Four floors of the huge structure in Lexington Avenue, each floor a square city block in extent, will be devoted to showing the progress of American chemists and chemical manufacturers during the past year.

These figures are interesting and important to the industry because they speak eloquently of the increasing vitality and steady growth of one of the country's most valuable possessions. Remove the chemists and chemical engineers from our midst, forbid the further practice of and education in the multitude of branches of that science, and the wheels of industry would cease to revolve to-morrow. In an unbelievably short period of time we should return to the darkness and superstition of the Middle Ages.

The fact that the average man has not as yet fully grasped this truth—as it is grasped in Germany, for instance—is one carefully to be remembered. It is encouraging, however, to record that he is advancing steadily toward a fuller realization of the role of the chemist in his daily affairs. Nevertheless, in spite of the tremendous impetus given to chemical manufactures by the war, the chemist as a class has not yet completely burst asunder those bonds of popular ignorance and misunderstanding which held him so long in thrall, unappreciated, unrewarded according to his merits, and unable to achieve, either for himself or for those whom he would have served, the results of which he was capable. Often limited in the practice of his calling by skepticism and the failure to be regarded seriously by far too large a proportion of our business men and bankers, as a class his advancement was retarded and restricted. That era is, happily, now almost at an end.

There is small danger of a reaction at this late day. The public has become awakened and the light is being spread with rapidity. Yet there must be no pausing or hitches; we must hurry ever onward, making full use of the momentum already acquired. It would indeed be a pity to waste it, and by refusing to slacken pace the task will be pushed through to completion in a gratifyingly brief while.

We know of no more potent single force for the propagation of the desire for further knowledge among the general public than the Chemical Exposition. Many there are who, having beheld the fearsome and intricate apparatus displayed, have felt a new-born urge to delve further into the mysteries of its application, and in this way have acquired their first grasp of the true significance of the nation's chemical industries. Even those who come from idle curiosity, gaze unthinkingly, go away again and imagine that they forget, are subtly affected. They do not wholly forget, but become fertile soil for the future sowing of seeds.

The continued development of the American chemical industries is so inseparably bound up with the receptiveness of the American people to chemical propaganda and their affinity for new chemical truths that *The Reporter* feels justified in making its appeal for universal support of the coming exposition on this ground alone. The people may be said to be polyvalent, and the industry must itself possess many bonds before a permanent combination can be effected. Again we repeat, the Chemical Exposition is one of the strongest of the bonds.

The Reporter will again maintain a booth at the Show this year and will extend to all who care to make it their headquarters a cordial welcome. We urge every one of our friends who can possibly do so to attend the event and, as many as can spare the time, to come and visit us. Not the least interesting part of our exhibit, we know, will be the September number of this new monthly journal, which, for rea-

sons set forth elsewhere in these pages, will be a different affair from the one now before the reader. We want your interest and friendship; we feel sure that you will approve of the next number, and if you will call upon us we shall be glad to see to it that you obtain a copy.

Not everyone, it is true, can attend the Show in person, for many must remain at work to keep business moving. Yet all can stimulate general interest in various subtle ways, and no one whose lifework is connected directly or indirectly with any one of the so-called chemical industries can feel that he has done his utmost for the future of himself and his associates who has not lent at least his moral support to the forthcoming Chemical Exposition.

A DUTY: ENROLL IN THE A. C. S. DYE DIVISION

The Dye Division of the American Chemical Society, which had its inception first as a dye symposium, then as a dye section, is now a duly organized part of the society. The division is undertaking to carry on regular and systematic work for the benefit of the dye industry of America in general; and the users of dyes, manufacturers of dyes, and dye chemists in particular, laying, of course, its especial emphasis upon the chemistry of dyes and dyeing.

It is the duty and the privilege of every chemist in America, who is interested in the chemistry, manufacture, or use of dyes, to enroll himself as a member of the American Chemical Society and of its dye division, and to attend and to participate in the semi-annual meetings. The advantage will be mutual, both to the members and to the industry.

To enroll yourself in the division, write to the secretary of the division, R. Norris Shreve, 43 Fifth Avenue, New York City. Give to the secretary your address and also inform him if you have ready for presentation any paper on the manufacture or application of dyes and intermediates. Enclose the sum of \$1.00 as dues for 1920. (Dues are for the expenses of the division, consisting mainly of postage and stationery.) It is planned as soon as funds permit, to compile and distribute a directory of dye chemists who are registered in the dye division of the A. C. S.

The next meeting of the dye division will be at the Fall meeting of the American Chemical Society, to be held in Chicago Sept. 7 to 10, 1920. At that time it is expected that a number of dye concerns will come forward with papers of intensive scientific interest.

There has been some considerable feeling in the past that the concerns should keep all their research work secret, and that none of it could be revealed at such meetings without detriment. However, since every research laboratory turns out a large amount of work which is of very great scientific interest to the trade in general but may have no specific bearing on any process in particular, it is expected that a large number of papers will

be presented of such a nature as to demand the attention of every dye laboratory.

Please plan to attend this meeting and inform the secretary of the title of any paper pertaining to the dye industry that you will have ready for presentation. An enrollment blank will be found among the pages of this issue, and The REPORTER urges all eligibles who have not already enrolled to do their duty in supporting this organization, which will mean so much to the industry.

GERMAN CONTROL OF THE COAL-TAR INDUSTRY

An official board has been appointed by the German Government for regulating the coal-tar trade. It is called "The Economic Union for Crude Coal Tar and Coal-Tar Products," and will supervise trade in crude coal tar, coal-tar oil, fuel oil, briquet tar, and similar coal-tar products. Its membership is made up of agents from the crude coal-tar factories, the intermediate factories, and the trade in consumer circles, and numbers 45 members in all. The workmen are also represented. The board has power to appoint subcommittees to fix prices, control imports and exports, and work out schemes of distribution.

SILK PRODUCTION IN JAPAN

The year ended in May was one of the best for Japan's silk industry, owing to the prosperity in the United States and the lack of supplies from Europe, says the *Japan Times and Mail*. The export figures from June, 1919, to May 31, 1920, reached 517,311 bales, an excess of 50,305 bales over the previous year. The previous largest figure was less than 500,000 bales.

The silk production of the country has attained a remarkable development during the past few years, especially during the war period, in which the world's demand for silk yarns was centered on the Japanese market, owing to the decline or stoppage of the sericultural industry in Europe. Though the sudden depression of the business caused by the financial failures toward the closing part of the silk year dealt a severe blow to the trade, the production for the season was still a record.

NEW EQUIPMENT AT NORTH CAROLINA STATE COLLEGE DYEING DEPARTMENT

During the past year considerable new equipment has been added to the Dyeing Department of the North Carolina Textile School, Raleigh, N. C., which is a department of the North Carolina State College.

In equipping the dyehouse the aim has been to obtain dyeing machines of such size as to be of practical use to students and also large enough to give practical demonstrations in dyeing. The dyeing machines have a capacity of about 150 pounds.

Included in the equipment are the following machines: Delahunty dyeing and bleaching machine; vacuum circulating raw stock dyeing and bleaching machine; Proctor raw stock drying machine; Schaum & Uhlinger extractor;

Hussong skein dyeing machine and skein bleaching machine; cloth boiling out kier; five can dryer, yarn printing machine, etc. This gives a very complete outfit for bleaching and dyeing.

The dye laboratory contains balances, microscopes and all other apparatus used in this work. The laboratory is

well supplied with dyes sent to the school by the dyestuff manufacturers.

A four-year course in textile chemistry and dyeing is given. Students taking this course also those taking the regular textile courses use the dye laboratory and dye house in their study and work.

Transmissions

By DR. A. H. LANG, C.E.

FOR the profitable operation of any plant it is, above all, essential to have all the installations put in with the greatest skill possible, giving best results at a least cost of installation. Of course, all the big concerns have their own engineers, familiar with all the details; but since the United States has undertaken to build up an independent chemical industry, a discussion of the proper installation of transmissions may be of general interest, for the simple reason that during the last years not a single week has passed but that a new company has been formed with the intention of undertaking the manufacture of chemical products. These companies very often put the installation of their plants in the hands of their chemist, who, while being able to manufacture the required products, at the same time in many cases was not familiar with the installation.

The general idea in the installation of transmissions is to obtain the maximum in driving power with the least amount of motive power. Therefore it is essential to have all the parts of the transmissions as light as possible.

Beginning with the main shafting, this, as well as all the by-shafting, has to be as light as possible considering the foregoing. On the other hand, the inflection due to the weight of the shafting, as well as to the weight of the gears, must not be forgotten. To be able, therefore, to get the least inflection, the load pressing on the shaft should always be nearest to the bearings..

Good dimensions are:

Thickness of Shaft	Length Between Two Bearings
1½ inches	4 feet 3 inches
2 inches	5 feet 0 inches
3 inches	6 feet 2 inches

The next point to be considered is the number of rotations. Increasing the number of rotations means a decrease of the power required for the transmissions, the strength of which depends only upon the power pressing upon them, and not upon the number of revolutions. It is evident, therefore, that with rapidly rotating transmissions all parts can be lighter than

would be practicable with more slowly revolving transmissions under the same conditions.

With fast rotating transmissions, all the parts, shaft as well as all the bearings and couplings, being lighter, the diameter of all the pulleys used being smaller and therefore again all the belting being lighter and the friction less, the cost of installation, as well as the cost of power required, will be less..

For certain reasons, however, the number of revolutions has to be limited, to a certain extent, and practical experience has shown that the following number of revolutions for shaftings are the best: 120 to 150 per minute for driving heavy machines; 130 to 200 per minute for driving light machines.

The medium now which transmits the power from one shaft to the other, or from pulley to shaft and thence to the kettles, is either the belt or the gear.

The belt drives are by far the most used, and in most cases are preferable to any other drive, though very often one can hear that the gear drive is to be preferred to the belt drive.

The reasons for this is an erroneous conception that the friction between pulley and belt, which is necessary for transmission, will only result through the tension of the belt, and that therefore the belts are exerting a greater pressure on the shafting than the gears. But now the fact is clearly established that the tension of the driving belt does not solely result through the counter-tension in the driven belt, but the air also is pressing the belt to the pulley, and a belt pressed in such a way to the pulley requires only a very small counter-tension to transmit all possible power. The most important factor is getting an intimate contact between belt and pulley. The belt, therefore, is always put on in such a way that the smooth part is on the pulley.

Furthermore, single belts are preferable to double belts, since the thin belts can be laid better on the pulleys than the thick ones.

The belt drives can be used for transmission for short or long distances. With crossed belts the distance should not be too short, on account of the friction, nor too long, in order to prevent loose contact.

The following will show the importance of properly

installed transmissions: A shaft 15 feet long, consisting of one part 9 feet long with a diameter of 2 inches and another part 6 feet long with a diameter of 1 foot 5 inches, is expected to produce the power of 12 horses with 80 revolutions per minute with a pulley of 31 inches diameter, in order to transmit that power to the kettles at three points through pulleys of 19 inches diameter each..

The proper installation, then, will give us the following dimensions and weights:

	Pounds
9-ft. shaft, 2 in. diameter.....	281
6-ft. shaft, 1.5 in. diameter.....	158
1 pulley, 31 in. diameter, 6.5 in. wide....	230
3 pulleys, 19 in. diameter, 4 in. wide (per piece)	80
1 coupling, 1.5-in. bore.....	81

Of these the following are on the 2-inch bearing:

	Pounds
9-ft. shaft, 2 in. diameter.....	281
3-ft. shaft, 1.5 in. diameter.....	79
1 pulley, 31 in. diameter, 6.5 in. wide....	230
2 pulleys, 19 in. diameter, 4 in. wide....	160
1 coupling, 1-in. bore.....	81
Total	831

And on the bearings of 1.5 inches diameter:

	Pounds
3-ft. shaft, 1.5 in. diameter.....	79
1 pulley, 19 in. diameter.....	80
Total	159

Suppose now that all the belts draw at an angle of 45 degrees downward and the pressure transmitted through the tension of the belts to the bearings is equal to the double effective belt tension. Then the load transmitted through the tension of the belts upon the bearings of 2 inches diameter is:

$$2(237 + 2.180) = 1,234 \text{ pounds}$$

if in the calculation the main shafting has an effective tension of the belts of 237 pounds and each of the three other shafts 180 pounds. This load of 1,234 pounds, pressing down at an angle of 45 degrees, gives, together with the load of 831 pounds which presses perpendicularly down on these bearings, an active load of 2,065 pounds. Supposing, further, the coefficient of friction to be 0.07, then the tension resistance through this load will be:

$$0.07 \cdot 2,065 = 145 \text{ pounds}$$

This tension is effective on the circumference of the

shafting of 2 inches diameter, which at 80 revolutions per minute gains a lengthwise speed of 8 inches per second, so that the loss due to friction will be:

$$\frac{145.8}{1,900} = \frac{0.61}{2} = 0.3 \text{ horsepower}$$

Furthermore, the load on the bearings of 1.5 inches diameter bore through the pull of the belts corresponds to

$$2.180 = 360 \text{ pounds}$$

which, together with the perpendicular weight of 159 pounds, gives an effective load of 519, producing a resistance tension of

$$0.07 \cdot 519 = 36.33 \text{ pounds}$$

The lengthwise speed of a shaft of 1.5 inches diameter with 80 revolutions per minute is 6 inches per second. The loss due to friction is, therefore,

$$\frac{36.33 \cdot 6}{1,900} = \frac{0.114}{2} = 0.057 \text{ horsepower}$$

Under proper conditions, therefore, a transmission of the above given proportions would require

$$0.3 + 0.057 = 0.357 \text{ horsepower}$$

It is evident, therefore, that in buying or installing heavier parts as required a loss in money will result, due to the higher price of the heavier parts, as well as due to the overuse of horsepower, which again means an overuse of fuel and lubricants.

CONCRETE CONSTRUCTION FOR MODERN KNITTING MILLS

(Continued from page 18.)

gineering principles and good judgment, combined, in the case of old-plant extension, with some ingenuity in devising rearrangements; and finally there is required the ability to see the problem as a whole clearly and to adapt the proper relative value to the importance of each department, so that the whole enterprise when completed may be well balanced and meet the requirements of the manufacturer in the best way possible in view of special conditions to be met.

POSSIBILITIES OF IMPROVING OLD MILLS

The foregoing discussion briefly summarizes the more important considerations that are taken into account by modern progressive industrial engineers in designing new mills. There is a large field of opportunity for improving older mills, in which a few, or sometimes almost all, of these desirable features are lacking. In the growth of any plant, as it takes

place from year to year, the natural tendency is to take each step toward increasing production by the easiest and least expensive method. No one of these steps may depart very far from the proper path. But a start once having been made in the wrong direction, even if the deviation is but slight, is very apt to produce a cumulative effect that after some years of growth results in a badly arranged, poorly lighted, unsanitary and ugly mill, and one in which the cost of production is surprisingly larger than it should be. It is safe to say that in the majority of mills over a dozen years old a careful study of the conditions by competent industrial engineers will disclose possibilities of increasing production, decreasing operating costs, and improving lighting and sanitary conditions at comparatively small expense and with little or no additional building operations. A study of the heating and power plant conditions in old mills, including the utilization of exhaust steam and condensate and hot circulating water from condensers, as well as operating methods, almost invariably discloses that large economies may be effected with comparatively small expenditures. Many mills that to-day are finding it difficult to meet the demands for production, and whose owners hesitate at the large outlay required for new buildings with the existing high costs of building operations, are neglecting opportunities to vastly improve their situation by a very modest outlay.

Much of what has been said will sound trite to you; but the most obvious things are the most often overlooked, and it is well for all of us to sometimes check up the things we know best in order to see that we are not unconsciously neglecting a principle that is so old and so well recognized that we have stopped thinking about it.

COAL-TAR DISTILLATION IN AUSTRALIA

The Melbourne & Metropolitan Gas Co., which serves an area carrying a population of over 600,000 and carbonizes annually from 250,000 to 300,000 tons of coal, is considering plans for the installation of an extensive distillation plant for the recovery of benzol and other valuable by-products of coal tar which now run to waste.

The cramped condition of the company's works, situated in a densely populated industrial district, is an obstacle in the way of proceeding with the enterprise immediately, but in the view of the importance of the industry and the economic waste entailed by inaction the location difficulty is likely to be overcome by the State Government making available a suitable area on the Yarra River front. Furthermore the Melbourne company has been induced to take action by reason of the success of the by-products installations of the Australian Gas Light Company in Sydney. From the tar products of gas making the Sydney Company recovers large quantities of ammonium sulphate, benzol, liquid fuel, motor spirit, toluene, solvent naphtha, naphthalene, and pyridine. Some of the oils obtained by distil-

lation are sold for liquid fuel and others are disposed of to manufacturing concerns which use them in the making of disinfectants.

The plant cost £40,000 [\$195,000] and at present it treats only 200,000 tons of the 400,000 tons of coal used annually by the company, but nevertheless the revenue produced from the by-products is about £140,000 [\$681,000] a year. At present the company recovers, in addition to other products, 30,000 gallons of benzine and toluene, for conversion into motor spirit, per year, 150,000 gallons of oils for disinfectant manufacture, 30 tons of crude naphthalene, and 400,000 to 500,000 gallons of liquid fuel. The revenue thus produced has enabled the company to refrain from increasing the price of gas as much as it otherwise would have done. The whole of the coal carbonized by the Melbourne company is brought by sea and rail from Newcastle which add very materially to the cost of gas production. It is computed that the entire cost of transport could be met by the revenue secured from a modern distillation plant.

LOWER PRICES FOR CALCUTTA INDIGO

In general prices for Calcutta indigo ruled on a lower basis in 1918-19 but with a rising tendency as the year closed. Prices averaged \$97.98 per Indian maund (1 maund = 82 $\frac{2}{7}$ pounds) compared with \$121.98 per maund in 1917-18. Exports show a decline in quantity and a larger proportional decrease in value.

On the whole the year was not favorable to planters, owing chiefly to a deficiency of moisture. The area planted with indigo in the past season was 58 per cent less, the dye output as a result falling by 50 per cent; the Madras yield was less by 33 per cent, that of Bihar and Orissa by 39 per cent, and that the United Provinces by 78 per cent. From Bengal, exports were less by 3 per cent, but owing to lower prices the total value receded by 21 per cent. Japan took a much increased share, advancing to second place in the list, but smaller shipments went to the other two important destinations, the United Kingdom and the United Kingdom and the United States. At the local auctions the highest price for Bihar indigo was \$185.74 in March, 1919, and the lowest \$41.36 per maund in October, 1918. Imports of indigo seed fell from 360 to 271 hundredweight (all from Java). The cess on indigo realized \$8,183.

COTTON-WEAVING INDUSTRY FOR SWATOW

Acting Commercial Attache C. C. Batchelder, Peking, China, reports that efforts are being made to develop a cotton-weaving industry in Swatow, in view of the abundance of labor and excellent climatic conditions. There are at present no cotton-weaving factories in Swatow, but as the local commissioner of defense is planning to erect one, there might be a market for weaving machinery if extended credits could be given.

WATER AND WATER EQUIPMENT

(Concluded from page 10.)

STEAM BOILER WATER

The water used for the production of steam in a boiler should possess certain qualities, not so much because of the steam produced as because of the effects upon the apparatus. The steam that rises from the water is practically nothing but H_2O . But a residue is left in the main body of water. Solid matter held in solution increases in relative amount, and generally the ultimate result is some kind of a deposit. This deposit may be loose and in the form of a powder. The accumulations in a boiler of this refuse are known as *boiler mud*. This by-product of

boiler operation creates relatively no great problem. But the deposit may consolidate and may adhere to the metal surfaces. An incrustation is then formed. This is known as *boiler scale*. There are mechanical methods which proceed by breaking up and tearing away the incrustations. Then there are chemical compounds and compositions which are to operate inside the boiler either by preventing the formation of scale or by "softening" and releasing it. Or the internal use of chemicals may be carried on in conjunction with mechanical removal.

Another remedial measure operates by chemically treating the water before its entry into the boiler, with the view of producing a boiler water free from any tendency to form deposits of any kind.

Influence of Finishing Processes on Woolen Fabrics

(Abstract of a paper read before the West Riding Section of the Society of Dyers and Colourists.)

By EBER MIDGLEY

PROFESSOR MIDGLEY said he proposed to discuss three aspects of his subject: (1) The influence of crabbing of union goods and wool goods; (2) mechanical manipulation and chemical treatment of union goods, as illustrated in mercerizing and schreiner, and (3) defects developed during dyeing and finishing.

PRINCIPLES OF CRABBING

Crabbing was an essential process in the finishing of goods composed of materials of different shrinking properties and of a varying order of interlacings of warp and weft. A woven fabric as it left the loom was more or less a mass of unbalanced strains, and unless these strains were balanced and reduced to a state of equilibrium there would be a great tendency for the fibers and yarns to shrink irregularly and give the fabric a wrinkled or cockled and unsalable appearance. Under the influence of moisture at a high temperature the wool fiber swelled and became plastic, and as a horny substance it readily took up a position forced upon it. This position was permanent if it was maintained until the fiber became cool, and was not subjected to subsequent influence of moisture. When prepared for crabbing, the cloth was in roll form and the necessary degree of application of smooth surface was provided by the pressure of one layer of cloth on another, which became intensified as the process was continued. As the correct degree of pressure was an essential factor, the amount of tension applied to the cloth during winding and rewinding was important. Indeed, it was correct to state that crabbing made or marred the fabric. The degree of crabbing varied ac-

cording to (a) quality of material, (b) structure of yarn, (c) weave and structure of fabric, (d) type of finish required. As these factors varied considerably, each type of cloth had to be separately considered and treated accordingly. Irregular treatment and excessive or insufficient tension during the crabbing process might be responsible for the cloth becoming unmarketable. Such defects as watered, cockled and crimp effects were very often due to indiscriminate crabbing.

In high qualities of worsted the process of crabbing was often omitted, as the material was made from good qualities of Botany yarns, where the uniform length and diameter of the fiber resulted in more uniform shrinkage. The lower the quality of the material the greater variation there was in the length and diameter of the fiber and lack of uniformity in the shrinkage of the texture. Worsted materials were given quality numbers which originally represented the spinning property of the material, but in addition their shrinking properties and also variation in shrinking properties were indicated.

Quality Numbers	Variation in Length.	
	Extreme Long to Extreme Short.	
	Inches	Inches
28's.....	15	2½
36's.....	12½	2
44's.....	11	2
50's.....	9	1½
60's.....	5	1½
70's.....	4¾	1½
80's.....	4½	1½
90's.....	4½	1½

The preceding table shows the variation in length of fibers in various wool qualities. The variation indicates to the cloth finisher (1) the amount of uneven shrinkage, (2) the necessity of crabbing certain qualities and also a varying degree of treatment.

The crabbing of a crossbred serge made from, say, 36's quality tops must be of a very different character from a cloth produced from 60's quality; also, the lower the quality the more severe the treatment.

Another factor which influenced the degree of treatment was the type and twist of yarn. As the twist of yarn influenced the shrinkage of a cloth, so any variation in the twist of a yarn created similar conditions to a variation in length and fineness of the fibers. Cloths composed of unevenly twisted yarn might be so treated during crabbing as greatly to diminish the risk of irregular shrinkage and the production of a defective crimped fabric. Fabric composed of two or more weaves very often created conditions which were equivalent to the combination of two or more materials.

MECHANICAL MANIPULATION

To a certain extent the limit appeared to have been reached in the types of raw materials and the structure of yarns employed in the manufacture of textiles, but there was no limitation to the mechanical efficiency of the manipulation of the materials employed and the chemical treatment of those materials to provide them with new and improved properties. No section of the textile industry offered so many opportunities for original research and experiment in this respect as the dyeing and finishing section, and greater progress has been made in it than in any other. A typical example was that of lining cloths known as Italians, which were originally produced from a cotton warp and a fine Botany weft. By suitable chemical and mechanical treatment, known as mercerizing and schreinerizing, this material had been superseded to a great extent by an all-cotton fabric on which the luster was developed much superior to that obtainable on the original and more expensive make of cloth.

There appeared to be a great opportunity for further application of chemical methods in cloth finishing for obtaining improved handle, appearance, firmness and permanency of finish, in addition to providing fabrics with new properties.

DEFECTS DEVELOPED DURING FINISHING

Defects in woven fabrics constituted a serious loss, and their prevention should therefore receive careful consideration. Their prevalence had apparently increased, as the standard of perfection was higher twenty years ago than at the outbreak of the war. Evidence of this was indicated by the employment of a largely increased number of burlers and menders.

This prevalence had been accentuated by the conditions brought about by the war, during which goods had been passed which in normal times would have been rejected and become job lots. Defective fabrics were disagreeable realities, and as such must be faced in the spirit that prevention was better than cure. Many types of defects could rarely be remedied, but an effort should be made to avoid them.

The defects developed during the dyeing and finishing process were most difficult to account for and to trace to their source, because the production of finished cloth from greasy wool was dependent upon so many processes and controlled by so many different persons that there must always exist a certain liability to error and imperfect goods. There was always a tendency to ask at once, "Whose fault is it?" and then, if possible, make the guilty party pay. Investigation was necessary if defects were to be diminished and the standard of perfection raised. Imperfections created in the early stages of manufacture reduced output during weaving, in addition to creating dissatisfaction on the part of the weaver.

The most serious irregularity and the most difficult to account for was that styled "crimps." This defect was developed during the dyeing and finishing process, where the wet processes developed the shrinking properties inherent in the fabric. Uneven shrinkage and movement of the fiber, being the cause of the defect, indicated an absence of uniformity in either materials or treatment in any process from fiber to finished cloth.

ARTIFICIAL CONDITIONING

The artificial conditioning of yarns on bobbins, so extensively practised at the present time, was to a considerable extent responsible for this type of defect. The outer layer of yarn on a spool received all the moisture applied, with the result that a mechanical and in some instances a chemical alteration took place in the parts of the yarn affected, while the yarn under pressure near the center of the spool was not affected to the same degree. The wool fiber when wet reverted to its original crimped and curly form, and as it curled became shorter in length and caused portions of the yarn to contract. Yarn below the surface of the spool was held tightly by the outer layers, hence the moisture was unable to penetrate equally to all portions of the material, while the pressure prevented the fibers from altering their positions. These conditions very often resulted during dyeing and finishing in indefinable stripes being created across the piece of varying dark and light stripes of color, situated intermittently and of varying size. This was due to varying absorption of light by the portions of the yarn which had been unevenly conditioned. The nature of this cause had been strikingly exhibited with regard to a cloth which had been submitted for examination because of this defect. A thread of yarn

taken from the affected portion clearly showed the defect, some portions of the yarn being comparatively straight compared with the crimpiness of other portions. To prove the matter decisively a similar yarn was taken, and some of it woven without artificial conditioning. The cloth proved quite satisfactory. Another portion was woven from yarn which had been artificially conditioned, and the defect was reproduced.

It would be seen from the slides shown that the length of pick (i. e., the length of thread from the top

to the bottom and back of the cone during winding) was an important consideration. If the length of the pick was equal to the width of the woven cloth, or to a multiple of that width, the unevenness caused by artificial conditioning would be fairly evenly distributed; but in other cases there would result the defect mentioned. There were obvious advantages to the manufacturer and dyer and finisher if unconditioned yarn only were employed—*Journal of the Society of Dyers and Colourists*.

Vigoureux Printing of Worsted

By J. M. GAUDIT

From "*Revue Generale des Matieres Colorantes*"

IN vigoureux printing it is sometimes necessary to add bleached wool. This may cause serious difficulties by reason of the flame effect, but it is possible to overcome the trouble in the following manner: The unbleached sliver that is to be added is printed a blue or very bright violet with a 50-50 roll, care being taken to have the color form merely a tint. The color becomes fixed in a few minutes and prevents the wool from turning yellow, particularly if care is taken to ventilate the material after steaming. The wool printed in this way gives a very attractive appearance of being bleached and has the advantage of mixing in all preparations without causing the flame defect or destroying the vigoureux effect.

Having established the fundamental principle of vigoureux printing, it is necessary to understand the operation of the machine in practice. Omitting the reference to the gilling operation which serves to open up and spread the wool, we will direct attention to the printing mechanism itself. This printing mechanism consists of a wooden tank in which the color is placed and a rubber-covered roll which carries the color on to an iron roll covered with a seamless cloth cover on which the corrugated copper printing roll rests. It is between these two main rolls, last named, that the gilled wool passes.

The corrugated cylinder is pressed with more or less force on the wool, which is printed by absorbing the color from the cloth-covered roll only at such places as are subjected to the pressure of the upper roll. Thus, it is not the corrugated roll which carries the color to the wool, but it is the pressure of the raised parts of the corrugated roll which causes the wool to absorb the color. We place emphasis on this point in order that the reader may recognize the importance of the corrugated roll during the printing operation and of keeping it clean. It frequently happens that the corrugated roll picks up wool fibers. For reasons that we will later explain this fiber accumulates around the roll, filling up the grooves and

spoiling the parts of the wool that should remain free from color. It is therefore necessary to remove these fibers, or, better still, to prevent their accumulating on the roll.

We should likewise understand the function performed by the cloth-covered roll, which serves as an inking pad. It is this roll that drives the printing machine, including the rubber-covered roll which is immersed in the color solution, and also the corrugated roll. It is this cloth-covered roll which delivers the color to the fiber by the aid of the pressure of the corrugated roll. It is necessary, therefore, to have the color spread uniformly over the entire surface of the cloth-covered roll. This result is obtained by the pressure of the rubber roll which spreads the color throughout the cloth. This cloth should be elastic and very soft. During the process of printing the cloth becomes hard and loses its elasticity because the wool becomes felted, and in this condition it makes a very faint impression on the wool. This difficulty is remedied by covering the roll with a small quantity of worsted roving when the machine is first started. Cloth covers made of chlorinated wool have been used, as wool treated in this way is deprived of its fulling property. The results obtained by this method have been very satisfactory.

THE PRINTING OPERATION

Unlike other processes of printing on wool, the combed worsted sliver is not subjected to any preparation before passing to the machine. In ordinary printing the wool is usually treated with chlorine. It is advisable to have the wool perfectly scoured before passing through the chlorine solution, and even bleached before printing. In printing worsted sliver, however, none of these operations is practicable. Scouring would necessitate drying and regilling, operations so long and expensive as to be out of the question. Treating with chlorine cannot be thought

of, for, in addition to drying and gilling, the combed wool would lose its special property and become oily, especially when passed through the soap after washing. It is consequently necessary to print the worsted sliver as it comes from the combing machine, using suitable color solutions. Many years of experience were necessary to bring the vigoureux process to its present state of perfection. During this time various methods were recommended to make the wool more capable of absorbing the coloring matter. Several interesting patents were taken out for this purpose, but nearly all have been abandoned because of the introduction of new dyestuffs. Among the patented processes was one in which the fiber was wet before printing; with another the wool was mordanted cold or hot and printed with alizarine or chrome colors. It is well to know of these processes, for they may be useful in certain cases; such as superprinting, for example.

In addition to printing on white wool, the idea occurred to print black on worsted sliver that had been dyed light or bright shades. At first the black was printed on indigo tints, then on the principal colors, yellow, red and blue. Multicolor printing was also an object sought by experimenters. Various patents were granted for this purpose, but multicolor vigoureux printing has not made any progress and is now neglected.

USE OF DYESTUFFS

Natural dyes, such as logwoods, fustic, sumac, quercitron bark and sulphate of indigo, were used at first for vigoureux printing. These were followed by artificial colors, alizarine, anthracene and chrome colors. In recent years logwood has been used for black, and mixtures of logwood with fustic and alizarine to produce browns and olives. These coloring materials possess the property of giving very intense effects with various mordants, such as chrome, copper, iron, etc., but the oxidation of these colors continues until the fiber is cold, causing an increase in the depth of the shade desired, which varies in direct proportion with the lapse of time between the delivery of the wool from the fixing process and the washing of the fiber. This difficulty can be remedied by cooling the wool as soon as it comes from the steaming chamber; but this is only a partial remedy, as the natural dyestuffs bleed during washing. If for any reason the wool thus printed is not sufficiently washed, serious trouble may result. The dyes form insoluble color lakes imperfectly fixed on the fiber and remain attached to the wool, which sticks to the roll covering and parchment in the drawing process, causing imperfect results in the spinning process. The printing paste should consequently be prepared very carefully and the coloring materials selected so as to give the best results as to fastness and other desirable qualities.

As already stated, it is necessary that the printing

should be sharp and distinct and that the printing paste should not cause the fiber to stick on the corrugated roll. This difficulty can arise from two causes: First—The printing paste may contain lumps of thickening material which are imperfectly boiled and carried on to the cloth-covered roll, passing then to the corrugated roll, which at each revolution causes the fibers to stick in the corrugations. As the roll revolves very rapidly, it is easy to understand that many defects can result from such conditions. In order to remedy this trouble the coloring mixture is run through a fine sieve or it is boiled twice. Second—The printing paste may contain particles of insoluble material. This is a very serious trouble and difficult to remedy. The best way is to dispense with the use of the dyestuffs that cause the difficulty. In order that a paste may be well printed on the fiber it should not be too thick; it should be free from lumps and should not form a foam during the printing process.

The principal thickening materials to be recommended are lichen, which is a very economical thickener for colors used with mordants, and British gum for mordant colors. The thickener should always be well boiled and the mixture should form a thick syrup. An excess of thickener causes the fibers to stick on the corrugated roll, while a deficiency causes faint shades. To prevent the color from foaming, a small quantity of sulforicinate of ammonia is added.

Acids and mordants should be limited to acetic or formic acid and chromium fluoride. It is sometimes well to add chlorate of soda to the color paste in order to prevent its decomposition during the steaming. Theoretically this may be advisable, but it should be remembered that the vigoureux printing process is applied to a very delicate fiber which must retain all of its natural qualities if difficulties are to be avoided in spinning.

In vigoureux printing the rule should be to simplify the process. The less the wool is loaded with different substances during printing the less need there will be of expedients to remove these materials when the worsted is washed after steaming.

STEAMING

This operation should be in a wet state, with the steam expanded and without pressure. The steam is turned on for one hour and then shut off for one-half hour; then the first operation is repeated, turning on the steam for an hour. After cooling, the worsted is run through a back washer, with a dryer attached, which enables the material to be delivered immediately to the drawing process.—*Translated in "Dyestuffs."*

Germany's total consumption of raw cotton in 1913-14 was estimated at 2,062,183 bales. Of this total consumption, the Rhine district, chiefly engaged in spinning the coarser counts, accounted for 660,000 bales. Since the armistice, however, imports of raw cotton have not met expectations.

The After-Treatment of Fibers Dyed With Sulphur Colors

WHILE the results produced by many of the so-called sulphur dyestuffs are sufficiently fast for ordinary purposes, it frequently happens that an extraordinary fastness is demanded for some special use, in which case an after-treatment of the dyeings is desirable. The particular after-treatment to be employed depends largely upon the peculiar fastness desired, as one method may improve the fastness to washing without having any material effect upon the fastness of light or cross-dyeing.

Fortunately for the dyer, nearly all the sulphur colors act uniformly under the after-treatment, and a method that is suitable for one dye is equally applicable to others of the same shade; hence a formula that will work satisfactorily with one sulphur black can be used equally advantageously with another sulphur black.

The *After-Treatments* are better suited with black and blue dyeings, as the lighter shades are all somewhat changed by the process, although this latter fact may be taken advantage of where a particular shade of yellow or brown or red of extreme fastness is desired, in which case care must be taken that the exact amounts of ingredients and chemicals, and times and temperatures, are kept uniform, in order that there may be no deviation in the shade of the resulting dyeings.

The amount of the chemicals employed varies somewhat with the depth of the dyeings, but the following proportions and methods have been found practically satisfactory for use upon dyeings of the ordinary depth.

After-treatment with Air.—This method is the one usually followed in the dyeing of sulphur colors, and produces results which possess the ordinary fastness of the color employed. The object is to cause a uniform oxidation of the dye upon the fiber, so that the further exposure of the dyed goods will not change the resultant shade. After the goods are dyed they should be thoroughly and evenly wrung to free them from any adhering dye-liquor, and then allowed to hang in the air for about half an hour before rinsing. If the ageing in the air is conducted after the goods have been rinsed, the results are somewhat more even but lighter in depth of shade.

After-Treatment with Steam.—This method carries the oxidation somewhat further than that of ageing in the air, and hence the results are somewhat faster to light and washing than those produced by the latter method. The steaming must be accomplished in the presence of air, and it is advisable to allow the steam and air to enter the steam-box simultaneously. The goods should be steamed as soon as they are wrung out, in order that the fiber may not become partially dried, in which case uneven

results will be obtained. Any comparatively tight box may be used as a steam-box. The goods should be subjected to the joint action of the steam and air for about half an hour, and then rinsed and dried in the ordinary manner. Hot dry steam facilitates the operation.

After-Treatment with Metallic Salts.—This method of after-treating fibers dyed with sulphur colors is employed to increase their fastness to washing and light. When properly used these metallic salts have no tendency to harden or weaken the fiber. The dyed shades are somewhat greened by the use of copper sulphate, and slightly blued by the use of bichromate of potash, while a mixture of the two salts increases the depth of the shade without materially changing the tone. The fastness to light may be further increased by reducing the amount of bichromate of potash and increasing the quantity of copper sulphate.

The following are average proportions, which may be varied somewhat according to the depth of shade to be treated:

2 per cent copper sulphate,
2 per cent bichromate of potash,
5 per cent acetic acid;

or

3 per cent bichromate of potash,
5 per cent acetic acid.

The dyed goods are treated in a bath containing the above salts, at a temperature of about 175 deg. Far. for half an hour. The bath should always be absolutely clear, as any deposits of dyestuff or salts will cause spotted results.

After-Treatment with Acetate of Soda.—This after-treatment is particularly advisable for dyeings which are after-treated with metallic salts or in an acid bath, and is used to neutralize any free acid which may remain in the cotton fiber, and which might have a tendency to weaken the fiber during the following operations. Eight ounces of acetate of soda should be dissolved in each 10 gallons of water, and may be used most advantageously in the last rinsing water.

After-Treatment with Alkaline Salts.—Soda and borax are sometimes used as a neutralizing agent instead of the acetate of soda last mentioned, but their use is not advisable, as they possess no advantage over the acetate and are liable to cause a deterioration of the cotton.

After-Treatment with Formate of Soda.—This chemical is used as a substitute for the acetate-of-soda method, particularly for warps intended for union goods, and is resorted to immediately after the dyeing of the cotton,

as well as after the subsequent dyeing of the wool in an acid bath. Four ounces of formate of soda should be used for each 10 gallons water.

After-Treatment with Oils.—An after-treatment with oil is employed to overcome any harshness possessed by the fibers, and to remove bronzy shades and to convert over-dyed shades to their proper condition and depth. Goods thus after-treated are soft and usually possess added brilliancy. Almost any neutral oil or soap, soluble in water or forming a fine emulsion therein, is suitable for this purpose. The three following methods have been found to give most excellent practical results:

4 per cent Turkey-red oil,
0.5 per cent ammonia;

or

4 per cent monopol soap;

or

2 per cent soap,
2 per cent olive oil,
2.25 per cent soda.

After-Treatment with Basic Colors.—The brilliancy of sulphur-dyed fibers may be further enhanced by an after-treatment with basic colors, but as the results are

not particularly fast to light or washing, the method should be used only where brilliancy is required. The sulphur colors have a very strong affinity for the basic dyes, and a too rapid dyeing with the production of uneven results is liable to occur. To overcome this difficulty a very long bath should be employed, or a solution of the basic color should be added gradually and in several lots, the latter methods being preferable. This after-treatment is conducted in a cold bath to which 5 per cent acetic acide or alum has been added, the temperature being raised very gradually to about 175 deg. Far., the dyeings being finally rinsed in cold water.

After-Treatment with Direct Dyeing Colors.—A few of the direct dyeing colors can be dyed in a sodium-sulphide bath, and hence may be employed in the same bath with the sulphur dyes, but they are limited in number, and their suitability can be determined only by experiment. The direct dyeing colors may also be used to after-treat fibers which have previously been dyed with sulphur colors, by treating the fibers in a fresh bath with 10 per cent Glauber's salt; but as the direct dyeing dyes possess inferior fastness to light, their use for this purpose is not to be advised.—*Posselt's Textile Journal.*

Inquiry Department

Question—Although much has been said about the American dyes being equal to the prewar goods, I notice that linen skirts in jade and dark blues and cotton bathing suits in black and blue are not to be had in fast colors. Have you any comment to make on this?

WHOLESALE.

Answer—Our correspondent is correct in the main and the condition can be easily remedied if he and other distributors will politely but firmly insist on fast colors on such goods. The American manufacturers have produced a number of navy and indigo shades of blue, as well as maroon, brown, green and black, in sulphur dyes which are even superior to prewar goods, but the dyers in many cases are still using the cheaper direct dyes because, they claim, the trade is satisfied. Some dyers still use Congo Red, although they can obtain far better reds if they want them. Their excuse is that there is no complaint, hence the cheaper color will do. The better class of manufacturers are using the best colors they can get, and we believe that if you will make inquiries of the mills that have an established reputation you will find that you can obtain goods whose fastness is equal to every requirement.

Question—In dyeing a domestic Sulphon Cyanine on worsted yarn I have great difficulty in obtaining even dyeings. What is the best remedy for this?

Answer—Sulphon Cyanines, whether domestic or prewar, have the general property of dyeing wool rap-

idly if handled like ordinary acid colors, and consequently are likely to streak. To get even results set the dye bath with color only, omitting all Glauber salt or acid, and by starting at 160 deg. Fahr. and gradually raising to a boil and boiling one-half hour the bath will be exhausted. Under these conditions the dyeing is more even and is just as fast in every way as if a large amount of acid were used. Sometimes one-half of the weight of the dye in bichromate is added, but this is not actually needed unless other colors are used in making a combination and which require the chrome to fasten them. We have seen very satisfactory dyeings made in the manner described, after the dye had been almost condemned by the dyer who was unable to use it in an acid bath.

Question—I use a sulphur black to dye raw stock and yarns, and find it very fast to fulling, but the same dye on my warps will not stand a good hand scouring. What would cause this difference?

Answer—When you dye yarns and stock you perform an actual dyeing operation and the dyestuff becomes fixed on the fiber, but in a warp frame the cotton is only in the liquor a few minutes at a time. Even with six ends it scarcely gets ten minutes' actual dyeing, but as the bath is strong it has also some color put on by padding. The result may seem a full black, but all of the dye is not well fixed and consequently washes off. This point is now generally admitted, and when warps are required to be absolutely fast

they are best dyed on the beam in a beam-dyeing machine, where they get the full benefit of the dyeing operation.

Question—I am dyeing garments of all varieties into blacks and fancy colors, but have a great deal of trouble with the blacks—so many of them come out gray, and no matter how much dye I put on they do not seem to get better. What can I do to get good blacks? I use regular full-strength direct black, green shade.

Answer—In dyeing garments several things should be done which are rarely done. First, weigh, not count, the goods to be dyed; second, scour with 5 per cent soap and 5 per cent soda ash for at least twenty minutes at 140 deg. Fahr. to get rid of grease, dirt and acid from original dyeing, then rinse well; third, weigh out your dye, instead of guessing at the quantity, and use no more than 5 per cent of the weight of the goods with 20 per cent of Glauber salt. Dye at a boil for half an hour and cool in the liquor for half an hour, then rinse again, whizz and dry. Most garment dyers use too much dye rather than too little, and with most blacks the more color that is put on the grayer they become. Clean goods and not too much dye is the only secret.

Question—My bleached goods feel very harsh. What can I use to soften them without giving them a yellow cast?

Answer—When bleached cotton feels harsh it is a sure sign the bleaching action has been too strong and that part of the fiber has been changed to oxy-cellulose. In future cut down the strength or time of your bleaching, but to soften the lots you already have on hand use about 3 per cent phosphate of soda and 1 per cent turkey red oil at 140 deg. Fahr.

A cablegram from Singapore says that the existing stocks of gambier are reliably estimated at approximately 20,000 piculs of 133 1/3 pounds each in block of 4,000 cubes.

Review of Recent Literature

Deterioration of Bleaching Powder. (J. J. Fox, *Chem. Tr. J.*, May 8, 1920, p. 610.) Author found that bleaching powder packed in defective drums, which admitted moisture, rapidly lost its available chlorine. In two months bleaching powder moistened with water and stored in a closed iron vessel lost 40 per cent of its available chlorine, and in six months practically the entire amount. For export purposes, therefore, bleaching powder should be packed in as dry a condition as possible and under such conditions as to exclude all access of moisture and air.

The Development of Indanthrene Blue. (J. Pokorny, *J. Soc. Dyers and Colourists*, July, 1920, p. 201.) Author states that from his experience in dyeing cotton cloth (printed with para red resist) with Indanthrene Blue RS, he has found that sodium bichromate overoxidizes the blue to green, but that the green reverts back to the correct blue shade upon gentle treatment with hydrosulphite. He has also found that the presence of potassium bichromate in the printing resist is not only useless but is directly harmful as it occasions the formation of green stains on the blue bottom. These stains may be removed by hydrosulphate but the red becomes less vivid and must be revived with hydrochloric acid. In his experiments he found that manganese chloride alone is as good a resist as manganese chloride combined with potassium bichromate. This latter fact goes to show that the statements advanced in the Felmeyer-Grosner patent is incorrect. When using manganese chloride alone green stains were no longer obtained. Certain indanthrene colors are much improved by a simple steaming for one-half hour, with or without pressure. Prolonged steaming renders indanthrene blue faster to chlorine and converts the blue which has become greener by chlorine into the correct shade. Certain indanthrene dyes are also im-

proved by boiling in a soap solution, becoming both brighter and deeper by this treatment.

Means for Producing Color Effects in Textile Fabrics. (Brit. Pat. No. 139,373, 1920. *Calico Printers' Assn., Ltd.*, E. Schofield and F. Farnworth.) The invention relates to the production of color effects of a variegated or veined character, without the use of engraved rollers or blocks. The principle lies in the application of the color to one side of the fabric to ensure complete penetration and subsequently applying another color to the other side by allowing the same to drop on to the fabric.

Jig Dyeing Machine. (Brit. Pat. No. 139,971, 1920. J. Gaston and R. Rushton.) A modification of the ordinary dyeing jig is described whereby the formation of crimps is minimized. The mechanism is such that the cloth stretching rollers are each in turn running with and against the cloth, and as the drive for the cloth stretching roller, which is in action, is taken from the large roller not connected with the driving shaft, the amount of breaking action used for this roller is reduced by the power required to drive the cloth stretching roller.

NEW TEXTILE COURSE AT THE TEXTILE DEPARTMENT, N. C. STATE COLLEGE

A new course has been added to the courses already given by the textile department of the State College,

which is the Textile School of North Carolina. This new course will be known as the textile engineering course, and will make four courses offered by this department, as follows:

1. Four-year course in textile manufacturing.
2. Four-year course in textile engineering.
3. Four-year course in textile chemistry and dyeing.
4. Two-year course in textile manufacturing.

The same subjects are taught in the freshman year of the four-year courses, and this will enable a young man to select in the sophomore year that branch of textiles he wishes to follow.

In the textile engineering course, students will take up engineering subjects in the sophomore, junior and senior years, such as heat engines, power plants, motors, mechanics of materials, reinforced concrete, etc., together with other work in textile subjects.

In the textile manufacturing course the largest proportion of the work will be in textile subjects, such as carding, spinning, warp preparation, weaving, designing, dyeing, etc., especially in the junior and senior years.

The junior and senior years in the four-year course in textile chemistry and dyeing will be devoted almost exclusively to textile chemistry and dyeing.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

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IN 2 SECTIONS
SECTION 2

IN THIS ISSUE

Professor Louis A. Olney discusses matters vital to the future of the American dyestuff industry—protection, research, standardization, publicity and others—in an article entitled "What of the Future?"

In a clear and practical manner, Winthrop C. Durfee summarizes his experiences with the mordanting of wool to be dyed with colors sensitive to chrome and for after-chrome colors used on a mordant.

The advantages of the bleaching of textile fibrous materials by means of oxygen compounds are outlined by W. E. Hadley.

Harold W. Leitch explains the use of steam turbine exhaust in the woolen and worsted dyehouse.

And many other features of equal interest.

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Section 2

What of the Future?

Phenomenal Development of Dyestuff Industry in America—Protective Legislation Needed—The Future Dyestuff Laboratory and Its Work—Standardization of Dyestuffs—Uniform Color Cards—Dyestuff Nomenclature—Future Publicity

By LOUIS A. OLNEY

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THE daily press and the trade papers during the past five years have given very considerable publicity to the dyestuff and textile coloring industries. Recently, however, there seems to have developed a decided lack of interest, not so much on the part of the public as of the writers. This is very likely due to a feeling on their part that the American dyestuff industry has really arrived at a stage of development where it needs no more publicity than the steel, paper or numerous other industries which have been established facts in the United States for generations. To a degree their premise is right, for the development of the color industry in this country has been nothing less than marvelous; but, on the other hand, they are misleading themselves into false conclusions. The persistence and rapidity with which color chemists and manufacturers overcame obstacle after obstacle, and arrived so quickly at a point in development which in 1914 seemed almost impossible to those who really understood the complications and intricacies of the manufacture of coal-tar dyes, were misleading. They gave onlookers a feeling of security toward the industry which the facts did not wholly justify. To be sure, one of the greatest objectives has been accomplished—namely, ability to supply our absolute needs during a period of prolonged war—but it must be remembered that during such a period there is practically no foreign competition, and requirements, so far as variety of dyes is concerned, are reduced to a minimum.

WAR PERIOD ENDING AND PEACE ERA AT HAND

The war period, so far as the textile industry is concerned, is approaching its end. Many look upon the present depression as the beginning of the transi-

tion period between war and peace conditions. When peace conditions are actually obtained there is likely to develop an increasing foreign competition in dyes which will naturally lead to greater domestic competition along the same line.

It is unlikely, however, that dyestuff manufacturers, either here or abroad, will, in the near future, again produce commercially anything like the multitudinous variety of dyes for special purposes which were on the market before the war. Costs of manufacture the world over have risen to such excessive heights that it would be impossible to produce these specialties, for which there is such a limited demand, at prices which would appeal to the textile industry. Moreover, the war has taught the public generally that it is possible to get along quite comfortably without many of the great variety and extremes in color to which they were becoming accustomed, and it is to be hoped and expected that the next decade or so—during which the world will be paying its war debts—will witness a tendency toward simplicity and concentration on staples throughout the dyestuff consuming and manufacturing industries, as well as in other fields. It is extremely important, however, that American textile manufacturers shall have access to all desirable dyestuffs which are available to their foreign competitors, and it is to be expected that any dyestuff protective legislation which may be enacted by Congress will take cognizance of this fact.

In a similar manner publicity along dyestuff lines must pass from a war to a peace basis, and the present apparent lack of interest may simply represent the transition period in this respect. If these are the facts, would it not be well to pause at such a time and ask the question, "What of the future?"

The question is easily asked, but how about the

answer? Who is enough of a prophet to give one that shall stand the test of the facts as they may develop during the next decade? It is not exactly a case of one man's guess being as good as another's, for there are certain facts and conditions which must form the basis of any sane prediction.

PROTECTIVE LEGISLATION

Many will immediately place protective legislation as the most important element in any prediction. This surely would have been true several years ago and is probably true now, but as each year goes on this should become a diminishing rather than an increasing factor. The utter hopelessness of immediately settling the protective phase of the dyestuff situation for future generations will be apparent to those who, after following or attempting to follow the mental and verbal gyrations of the law makers and their advisers in Washington and elsewhere during the past year, finally attempt to sum up the results of their deliberations.

INTERESTS OF BOTH COLOR MAKERS AND TEXTILE MANUFACTURERS SHOULD BE CONSIDERED

All who understand the situation must admit that wise protective legislation on the part of the United States Government will be absolutely essential to the success of the dyestuff industry during the next five years, and perhaps longer. Protection must be given of sufficient degree and of such a nature as not only to *guarantee continued manufacture at a profit* of the two hundred more or less dyes which are now being made but to *encourage and make it possible to increase this list* so as to include a number of very important and valuable dyes sorely needed by American textile manufacturers but as yet not made in this country.

At the beginning dyestuff manufacturers were faced with the necessity of producing, in the shortest possible time, colors which could be used in great quantity for staple purposes. Because of the urgent requirements of the textile industry it was not possible to attempt at the outset the production of colors for the manufacture of which long and tedious research and experimentation were a prerequisite. Blacks, blues and khaki for the army, of satisfactory fastness, were in greatest demand, and upon these and other staple colors the initial efforts of American manufacturers were expended with most gratifying results.

As the most urgent requirements of the textile and other consuming industries were met, dyestuff manufacturers gradually turned toward the production of colors requiring greater research efforts, aiming not so much to produce dyes which were desirable for some one special purpose as those which had a variety of uses and could also be made, temporarily, to answer that special purpose as well.

The time has now come for the development of the

less used but highly desirable dyes for special purposes, and others which will be absolutely necessary if the American textile industry is to compete with many foreign-made colored goods.

In many instances several hundred thousand dollars are spent in the development of a single dye before it is a commercial success. It is common knowledge that the first pound of synthetic indigo sold at a profit had actually cost well over a million dollars. The expense of developing these new dyes, which in many instances will be enormous, must come from the profits of those already being made, and protective provisions must be adequate to provide for this. Failure to recognize this fact would be more fatal to the American color industry than anything else.

Legislators must not let the present antagonism toward the profiteer confuse the issue, but keep clearly in the foreground the facts of the case. The vast amounts expended by our dyestuff manufacturers for research and development demonstrate clearly that they look upon an adequate proportion of their profits as a trust fund for these above-mentioned purposes, and that they do not intend to violate that trust by diverting them for any other purpose.

Meanwhile the interests of textile manufacturers must be considered to a certain extent. As a body they are broad-minded, patriotic men and realize not only the desirability but the necessity of fully developing a domestic color industry. With this in mind they are willing to sacrifice and make substitutions here and there, but there is a point in this respect beyond which it would be unwise to ask them to go. It would therefore seem essential to provide, through legislation, some mutually agreeable method by which they could temporarily obtain from abroad such dyes as are necessary for competition with foreign-dyed goods and which are as yet not being manufactured in the United States. The workings of such a system of importation might well be left to the Textile Alliance or, perhaps better, to a somewhat larger body combining the Textile Alliance with representatives of other color-using industries, as well as the dyestuff-manufacturing industry itself. In any event, they must not be tied up with so much political and governmental red tape as to prove hopelessly complicated in petty details and "snail-like" in the procedure of their application.

THE IMPORTER'S INTEREST?

A third interest in the dyestuff situation is the importer. When dyestuffs were not manufactured to any extent in this country he was the leading factor in the American dyestuff trade. At this time he should be heard and given as much consideration as possible. He is, however, neither a producer nor a consumer, and his interests are therefore admittedly secondary rather than paramount. It is quite possible that his

future sphere will be that of a commission merchant rather than a free lance to buy and sell as he pleases.

PROSPECTS OF LEGISLATIVE ACTION AND ITS PROBABLE NATURE

It is apparent that nothing will be done along legislative lines until the new Congress assembles. Which ever way the election goes this fall, it is believed that the importance of adequate dyestuff legislation will be realized by those elected. Should the party win which for generations has advocated a comparatively high tariff, the dyestuff situation would probably be satisfactorily settled in this respect for a number of years. On the other hand, should the party win which through a similar period of time has stood for freer foreign trade and modified protection, there is every evidence that their representatives, realizing the importance and urgent requirements of the situation, will enact special protective legislation which will be acceptable to both dye makers and textile manufacturers. We may therefore look forward hopefully to the time when the legislative feature of the dyestuff situation will be satisfactorily settled for several years to come.

In the future development of the color industry, laboratory work of the checking-up type will always have its place and should be considerably extended rather than curtailed. Its value cannot be overestimated, for its ultimate objects are, first, to increase the uniformity of the product, which tends to establish the confidence of the consumer and increase the number of reorders; second, higher yields, which, as a rule, lead to cheaper dyes; and, third, greater purity, which means clearer and brighter dyes.

The type of research work which leads to radical improvements in an old process or the substitution here and there of entirely new processes is valuable, also the type of research which leads to the manufacture of dyes not as yet made in this country but already made abroad. Both are fundamental, and for the next few years such work should be conducted in an ever-increasing amount and engage most of the attention of the research laboratories. Our dyestuff industry, however, will never be an American industry in the strictest sense of the word until there are added to the list of valuable dyes a significant number of entirely new products never before made in any country and accredited to discoverers who are American citizens.

DANGER OF DRAWING TOO HEAVILY UPON TEACHING STAFFS OF EDUCATIONAL INSTITUTIONS

At various educational institutions throughout the country are well-equipped organic chemistry laboratories directed by men trained as research chemists. There is no reason why chemical work of great value to the industries could not be carried on in some of

these laboratories, but the greatest obstacle is the old-fashioned idea that the educational laboratory is many times removed from the industrial laboratory. As a result, many of these laboratories are applying the highest type of research capacity along lines which lead to nothing of specific value, except, of course, the training and experience which the workers obtain. These men would in most cases prefer to do work of constructive value for the color industry, but, not being able to find any direct point of contact, are ignorant of its commonest requirements or possibilities.

The managers of dyestuff industries, in the future as in the past, must look to the educational institutions for their chemists. The present tendency on their part is to pick from the various institutions of learning many of the best professors and instructors and engage them for their laboratories. They also take each year from the graduating classes the best men, at figures far in advance of what such institutions are able to pay to retain them as instructors. This practice has already begun to result in the deterioration of the chemical educational system of the country, and unless the chemical manufacturing industries take an attitude of co-operation in this respect they will eventually find themselves obliged to build up their working staffs with poorly trained, inexperienced workers who have never known the broadening and inspiring influence of minds greater than their own. In any event, it is evident that for the best interests of all concerned there must develop in the future a closer working relationship between industry and the educational institutions of the country.

Would it not, in many instances, be to the advantage of industrial concerns if, instead of taking the best trained men from the educational institutions, they should make an arrangement whereby some of them at least could remain where they are and serve them in the double capacity of properly training chemists for their future requirements and also of spending a reasonable portion of their time in doing for them work of exactly the same nature as though they were with them on full time?

STANDARDIZATION OF PRODUCTS

The matter of standardization must also receive much more attention in the future. Dyestuff manufacturers, realizing that the standardization of their products will become an increasing necessity as competition develops, are in most instances making every provision possible for its accomplishment.

The standardization of methods for determining and recording the fastness of dyes to the common color-destroying agencies has been sadly neglected. Textile manufacturers are not, for the most part, aware of the great advantages that might be derived from an officially recognized standard system of tests

for determining and of terms for expressing the fastness of dyes. It is hoped, and there is reason to believe, that in the near future something definite may develop along this direction.

STANDARDIZATION OF COLOR CARDS AND DYESTUFF LITERATURE

The matter of sample cards is also worthy of attention. It would be greatly to the advantage of the dyestuff manufacturers and dealers if in the future they would by joint agreement adopt some standard system of color display sheets and literature. In past years the "hodge-podge" of innumerable cards, books and folders of all sizes and shapes was the despair of every color chemist and dyer. It was impossible to file them away systematically, which fact sooner or later resulted in their being stored away and never used or eventually finding their way to the fire under the boiler. The loose-leaf system, on the whole, seems the best suited for the purpose. Recently at least one American manufacturing concern has adopted it, much to its credit. Two official sizes should be recognized, one of ordinary letterhead dimensions and the other just half the size. All dyestuff literature and sample cards should be put out in these sizes, if the originators would have them render the greatest service to the consumer and insure their preservation for future use.

DYESTUFF NOMENCLATURE

Much might also be done to advantage toward the standardization of dyestuff names. This rests largely with the dyestuff manufacturer and dealer, but the consumer in many instances can accomplish much by insisting upon knowing just what he is buying. When one thinks about it seriously, there is no more reason for putting certain standard dyes upon the market under as many different names as there are manufacturers than there would be for doing the same thing with sulphuric acid or caustic soda. While this practice may prove of advantage to the dyestuff manufacturer in imparting a certain individuality to his product and to the small dealer as a disguise, it in general results in far greater disadvantage to the consumer than is warranted by the advantages gained either by the manufacturing or the distributing interests. The tendency of the future will be gradually to eliminate this confusion, and the consumer should not hesitate when to his advantage to insist upon knowing in standard terms what dye he is buying. The question will in many cases arise as to what is the standard name, but wherever there is a chemist he can be easily satisfied, and there are many instances where there is no doubt whatever.

May I, in concluding, once more refer to publicity and its bearing on the future of the color industry? The motive of war publicity was to arouse to action,

and in this respect the objective was attained, as is evidenced by our well-organized dyestuff industry. The object of peace publicity is education, and publicity in regard to the color industry from now on should be along educational lines. The textile manufacturer should have full confidence in the color manufacturer, and vice versa, and both should have the full confidence of the public. This can be attained most readily and quickly through the avenues of intelligent and accurate publicity.

Fact rather than fiction, exactness rather than exaggeration, and admission, if necessary, rather than denial, should be the motto before all future writers upon textile coloring and the color industry.

LOADING AND FILLING IN SILK FABRICS

The practice of adding to the weight of silk goods in the dyeing and finishing operations has become so common, that it is necessary, in silk cloth analysis, to ascertain the amount of fiber present and the amount and character of the loading material.

Whether a fabric is loaded or filled on one side or impregnated will be detectable at once.—Goods containing such loading agents as starch will be recognized, as such fabrics, if rubbed between the fingers, will lose their stiffness. By the aid of a magnifying glass it can be ascertained whether the covering of filling is merely superficial or penetrates the cloth.

DETERMINATION OF MOISTURE

1. Weigh a suitable size of cloth in grains.
2. (a) Place the sample for about half an hour in drying oven.
- (b) Place the sample in a desiccator to cool down.
- (c) Weigh the sample in grains.

The difference between the first and final weighings indicates the amount of moisture. When the difference is more than the standard regain of moisture, a degree of loading may be suspected, since loading agents possess great hygroscopic properties.

DETERMINATION OF EXTRANEOUS SUBSTANCES

Test 1. 1 and 2 as in determination for moisture. 3. Expel the extraneous substances and ascertain the absolute dry weight of the pattern by:

- (a) Treating the sample at boiling heat with malt extract.
- (b) Rinse thoroughly in several changes of water.
- (c) Dry in oven and cool in desiccator.
- (d) Weigh in grains.

The difference between the weights of 2 and 3 indicates the amount of extraneous matter. As a few insolubles may remain, the sample is boiled for a short time in dilute acid and re-weighed after drying.

Test 2. As in Test 1 employing a 5 per cent solution of ammonia in place of malt extract and boiling for half an hour.

Notes on the Mordanting of Wool to Be Dyed with Colors Sensitive to Chrome and Especially for Afterchrome Colors Used on a Mordant

Necessity of Modifying the Process of Mordanting Wool with Bichromates when the Wool Is to Be Dyed on the Mordant with Afterchrome Colors (Mordant Acid Colors), Such Colors to Be Fully Developed by the Mordant and Not Aftertreated—Important Conditions Which Control the Process—Necessity of Freedom from Chromic Acid and from Loosely Deposited Chrome, and the Necessity of Fixing the Chrome in the Basic State Only—Desirability of Fixing within the Fiber the Minimum Amount of Chrome Desired to Unite with the Dyestuff Used Later—Necessity of a Decidedly Acid Mordanting Bath to Accomplish This Purpose—Formulae for Afterchrome Mordants

By WINTHROP C. DURFEE

Consulting and Manufacturing Chemist, Boston, Mass.

IN the last few years the scarcity of many of the true Alizarine colors has led to the use on mordants of colors primarily intended for afterchroming. While certain of these afterchrome colors work to a fair degree of satisfaction, they nearly all give trouble in one form or another. Though the colors produced are fast to light and soap and other agencies, and fill the requirements of the trade with a reasonable degree of satisfaction, their action on the mordant is so variable even between different makes of similar dyestuffs, that standard methods of mordanting for the dyewoods and the true Alizarine colors must be modified for afterchrome colors.

While there are a few mordant colors which are sensitive to chrome, and require special mordanting, almost all of the colors primarily manufactured to be dyed acid and developed by afterchroming, are somewhat out of place on a mordant, and therefore require special preparation. With the exception of those afterchrome colors that need oxidization, or apparently need oxidization to develop the shade, the larger number form chrome lakes of the same general nature as those produced with regular mordant colors. The difference is that the afterchrome colors are also acid dyeing colors and can be dyed into the fabric in the same manner that acid colors are usually dyed, and that after the bath is exhausted the color forms a lake parallel in some way to the old principle of stuffing and saddening.

The afterchrome colors that dye on a mordant successfully do not seem to be much affected by the oxidizing power of the chrome which, as a color, they resist satisfactorily. Nearly all the afterchrome colors seem to be more sensitive to chrome or more actively energetic in combining with chrome than the mordant colors to which we are accustomed. That they vary greatly in their adaptability to be used on mordants is a matter of experience. The question arises whether there is a system of mordanting that is especially fitted to afterchrome colors.

soda mordants. Such mordants are usually prepared with the use of 3 per cent of bichromate and various acid assistants which are familiar to the dyehouse. These mordant colors differ from acid dyeing colors generally, in that they have apparently very little affinity for the wool which, it would appear, must be mordanted in order to attract the dyestuff to the fiber. Mordant colors are generally somewhat insoluble in water and are suspended in the bath rather than dissolved in it. Acid dyes, however, including those intended for afterchroming, are as a rule soluble in water. They have a distinct affinity for the fibre. In the presence of acids they exhaust the bath and are completely, or almost completely, absorbed into the fiber, removing themselves almost wholly from the bath before the chrome is entered. The chrome used on afterchrome colors finds little or no coloring matter in the open bath to combine with, and is in its turn absorbed into the fiber where it combines with the color forming the color lake as before stated. It will be noted that under these conditions the chrome and the color are not associated in the open bath, or at least that color which is in the fiber, and whose fixation is the object of the process, is in its proper location before being made insoluble by the chrome.

Now, whenever these colors are used on a mordant good results are not as uniform, and phenomenal differences appear. These differences are due to differences in sensitiveness to chrome and to the fact that by the usual methods of mordanting there will be a leakage of chrome into the dye bath, which is capable of precipitating color before that color is absorbed by the fiber. It is, however, necessary to use these colors on a mordant in order to associate with them many valuable colors which are sensitive to the oxidizing action of the chrome, and which, therefore, do not stand top-chroming, and other colors which are sensitive to acids and do not stand acid dyeing. There are some colors in which both of these difficulties are encountered. Consideration of these facts establishes the required method of mordanting as being one in which there is no oxidizing power left in the chrome, and one in which it is impossible for any chromium compounds to diffuse into the dye-bath.

DYEING ON MORDANTS

Standard Alizarine colors and dyewoods are dyed satisfactorily on the bichromate of potash or bichromate of

ORDINARY MORDANTS PRODUCE CHROMIC ACID AND FREE CHROME

A series of careful experiments on one of these colors which is sensitive to chrome shows that it is practically impossible to dye this color on the usual mordant of 3 per cent of chrome with any of the well-known assistants that are entirely satisfactory with mordant colors. While some of these assistants are markedly superior to others, there are none of them, as ordinarily used, that give mordants entirely suitable for afterchrome colors. There are none in which the chrome is completely reduced in the quantities normally used. The result of this is twofold. First, that the mordant is a basic compound carrying fractions of unchanged chromic acid, and second, that the penetration is rarely perfect, and more or less surface chrome is attached to the fiber.

Under these conditions the yarn or cloth may be removed from the mordant bath and fairly well rinsed without disturbing the fraction of chromic acid which is held firmly in the mordant, and the rinsing will not seriously disturb the surface or contact held chrome. The dye-bath, however, in its relations to the mordant, is nearly equal to pure water, and this as the temperature rises will dissolve out the unchanged chromic acid in the fiber to some extent, and the mechanical conditions will remove some of the surface chrome. This action will take place the more rapidly the larger the proportion of unaltered chromic acid is to the true mordant or basic chrome, and the surface chrome will be more easily detached the larger its proportion may be to the whole chrome fixed, or in other words, in direct relation to the penetration. The answer is that the better the fixation of the chrome, and the better it is penetrated, the less will be the action of the diffusible chromic acid, or loose surface mordant, because less gets into the dye-bath.

SOLUBILITY OF MORDANT AND ACID DYEING COLORS

As a matter of arithmetic, a very small amount of free chrome will precipitate a very large amount of dyestuff in the open bath, and a very small amount of chrome properly fixed will combine with a large amount of dyestuff in the fiber, providing the dyestuff can reach the chrome. This question of the dyestuff reaching the chrome opens up a distinction between mordant colors and acid dyeing colors as to solubility or insolubility. Insoluble or semi-insoluble colors do not penetrate well and have to be boiled into the mordant. Many mordant colors are made insoluble in water by the presence of weak acids, and on addition of such weak acids as are ordinarily used, for example acetic acid, they have a tendency to concentrate on the surface of the fiber, making a film of paste color which is shown by the sudden dulling of the shade when acid is added to such a bath, but which on long boiling recovers its brilliancy—the boiling water successively dissolving small fractions of the insoluble or semi-insoluble dyestuff. The fiber meanwhile may be considered as carrying along an attached film of concen-

trated dyestuff. Although ammonia is sometimes used to increase the solubility of the usual mordant dyes, it at the same time decreases the affinity of the dye for the mordant in the same manner as any weak alkali will separate an acid from its base.

AFTERCHROME COLORS

Now the afterchrome colors, as acid dyes, dyed on a mordant, behave like acid dyes until they reach the chrome. These colors, with their great penetrating power, which corresponds to their leveling power, which again corresponds to their solubility, may be considered when acid dyed, as dissolved into the substance of the fiber. They are attracted to the fiber by the special affinity for it. They leave the water solution in much the same manner as dissolved materials can be made to leave one solvent and be taken up by another when two liquids that are not miscible with each other are shaken up, the dissolved material leaving one solvent and going to another for which it has more affinity, or in which it is more soluble.

Regarded in this light, the acid dyed dyestuff diffuses through the fiber and penetrates to the location of every particle of previously fixed chrome with which it can combine. Most of these colors seem to combine with the chrome with great rapidity as compared with what seems to be the case with mordant colors, but this may be a side function of solubility. In connection with this it may be stated that mordant colors seem to require more chrome for the fixation than the acid dyeing afterchrome colors used on mordants, and this may be conversely a function of insolubility, due to the slowness with which the insoluble or semi-insoluble colors penetrate the fiber, and therefore it appears advisable in practice to saturate the fiber with more chrome than is necessary so that the dyestuff may reach in a reasonable time a sufficient quantity of chrome to dissolve its shade. But the afterchrome colors which do not require oxidization take a comparatively small amount of chrome for the development of the shade.

NECESSITY OF STUDYING INDIVIDUAL COLORS

The problem, therefore, in mordanting for afterchrome colors used as mordant colors, is, first, to use the minimum amount of chrome that will produce the effect of developing the shade; and second, to have this amount of chrome so fixed that it is impossible for any fraction of it to diffuse out into a boiling dye-bath. The variable action of the different dyes in this direction makes it necessary to study each individual color in the strength in which it is proposed to be used, and to find the smallest amount of chrome used as a mordant that will produce the required shade in a manner that will stand the required finishing, and the demands of the trade. As already indicated the chrome mordant should be so completely reduced that it carries none of the original chromic acid, and that the chrome is entirely in what is called the

"basic" state. Or in the absence of further reducing agents the dyestuff often acts as one, if very small fractions of this chromic acid will diffuse out into the dye-bath.

STRONG ACID BATH NECESSARY TO DISSOLVE SURFACE-ATTACHED CHROME

Chrome when completely reduced in the fiber generally shows a transparency entirely free from any yellow or greenish cast, and when wet and held up to transmitted light may have a dull violet reflection, and may slightly bluish gray or drab when looked at directly. To avoid any surface-attached chrome which might diffuse into the dye-bath, the mordanted bath should be extremely acid, sufficiently acid to act as a stripping bath, in order that it may redissolve any of the attached chrome that it comes in contact with; that is, any chrome that is not so strongly held within the substance of the fiber that the acid cannot dissolve it away. The power of the fiber to hold basic chromium that is actually combined with it is very great, and there need be little fear of removing any large fraction of the truly combined mordant, by any ordinary amount of acid. This extra acid that is used in the mordanting bath for the purpose of dissolving away surface chrome also energizes the reducing effect of the assistants that may be used to the point of their exhaustion. This will indicate to the dyer whether the assistant in the quantity used has sufficient reducing properties for the desired results.

MODIFICATION OF ORDINARY TARTAR MORDANT

Inasmuch as the so-called tartar preparation is generally considered as normal and represents general practice, it is pointed out that many colors of afterchrome type could not be dyed on a mordant of 3 per cent chrome and 3 per cent of half-refined tartar. This mordant was always considered particularly well fitted for the usual mordant colors. An afterchrome color which could not be dyed on this mordant gave very much improved results when the quantity of chrome was reduced to 1 per cent, and the tartar kept at 3 per cent, but much of the color was precipitated. Further trials to increase the acidity of the bath without increasing the cost of the preparation were made. The fiber was mordanted with 1 per cent chrome, 3 per cent tartar and 1 per cent oil of vitriol with marked improvement to the previous result, but still far from satisfactory. The oil of vitriol was then increased to 2 per cent with a mordant of 1 per cent of chrome, 3 per cent tartar and 2 per cent oil of vitriol. The dyeing of this color on this mordant was practically perfect. In later trials chrome was increased 1½ per cent satisfactorily, but increases up to 2 per cent of chrome again injured the color; the color dyed on the mordant of 1 to 1½ per cent chrome, 3 per cent tartar and 2 per cent oil of vitriol was superior in penetration, depth and in clearness and in development to the corresponding amount of color dyed by the afterchrome method. The mordanted yarn before dyeing was almost

white. The exhaust mordant bath was practically water white (it showed no traces of chrome to the eye), and a sample of the bath when neutralized with ammonia showed a very slight precipitation of chromium hydrate, indicating that nearly all the chrome had been absorbed into the wool. A still more remarkable result of this mordant was shown in the dye-bath, as the afterchrome color used exhausted completely without any acid, leaving a dye-bath practically white, where, by the afterchrome system the bath was never completely exhausted even when large quantities of acid were used.

Apparently under this system of mordanting, the wool became highly acidulated and the dyestuff was absorbed into the wool in a manner somewhat different from the usual acid dyeing, and in the wool it combined with the chrome mordant. Experiments have been made carrying out this idea with several afterchrome colors, and with several such colors associated with mordant colors, particularly with mordant colors of the galloxyaniline series. In these experiments the galloxyaniline combined with the afterchrome color and exhausted fully with apparently water white exhaust, and seemed to avoid the fault of rubbing, sometimes characteristic of these colors. In the series of experiments only a few of the afterchrome colors were found that still require any acid in the dye-bath under this new method.

SUMMARY

When afterchrome colors are to be applied upon previously mordanted wool, the mordanting process must be such that the basic chrome mordant is deposited or fixed within the fiber, and there should be no surface-fixed chrome on the fiber capable of being released into the dye-bath, and there should be absolutely no chrome whatever in the form of chromic acid associated with the mordant when the mordanting process is completed. In order that this may be more perfectly accomplished trials should be made to determine the minimum amount of chrome that will accomplish the purpose of fixing and fully developing the dye, as the smaller the amount of chrome used the more perfectly it can be reduced and penetrated with commercially economical quantities of assistants, and the penetration accomplished which practically eliminates the danger of the surface chrome spoken of. Where one color is used in a large way in a mill these tests will be of great importance. The fundamental principle is that the mordanting should be such that no chrome compound of any nature whatsoever can leave the wool and diffuse into the dye-bath—a condition which cannot be avoided by even the best process of mordanting in general use.

Note.—Owing to the high acid nature of the mordanting bath the wool goes into the dye-bath quite sour, making this type of mordant unsuitable for colors highly sensitive to acids. Studies are now being made as to methods of neutralizing mordants for such colors or the alternative desirability of using alkaline solutions of such colors on this mordant.

Standard Dye Tests and Standard Records—A Plea

By LOUIS A. OLNEY

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IN a statement so condensed that even the busy man can and will take time to read it, I wish to make a plea for greater efforts toward the standardization of methods of dye testing and uniform methods for recording such tests.

Every user of dyes is interested in the fastness of his colors toward one or more of the following color destroying agencies: Light, washing, scouring, bleaching, acids, alkalies, fulling, carbonization, perspiration, etc.

As yet no official methods of making or recording such tests have been accepted by any duly authorized body, and much confusion and no little misunderstanding is constantly arising between various interests particularly the textile manufacturer and the dyestuff maker and dealer.

In many instances the large textile manufacturing interests have worked out rather elaborate systems for their individual requirements. Some of the foreign dyestuff concerns have also done more or less along this line, but their work has always been from the point of view of the dyestuff manufacturer or dealer and not particularly in the interests of the consumer. No organized effort has thus far been made with the object of adopting a standard working agreement or system, mutually acceptable to the various interests.

As a result, one textile manufacturer attempting to communicate with another or with a dyestuff dealer in regard to the fastness of a certain dye is often at a loss to know by the statements made just what degree of fastness the other intends to convey and whether they are all in agreement with each other. The economic losses arising through such misunderstandings and which might be eliminated, partly at least, through official standards cannot of course be measured, but must run into very many thousands of dollars each year.

The difficulties and the expense which would be encountered in the perfection of such standard methods

have in a way delayed their introduction, but the chief cause of postponement has been the lack of realization that such a series of tests could be devised and adopted.

In the writer's opinion the establishment of such a set of officially recognized standard methods of dye testing is possible, but before any headway can be made toward this end three essential requirements are absolutely necessary.

1. Development of sufficient interest on the part of both manufacturers and consumers of dyes, but particularly the latter

2. Accurate research and experimental work extending over a considerable period of time.

3. Sufficient funds to carry on such work.

Sufficient interest will develop as soon as the extensive users of dyes throughout the country realize the value of such a series of officially recognized tests. As soon as such an interest develops the funds will be forthcoming, as has been the case with co-operative movements on the part of other industries. As soon as the funds are forthcoming the proper workers may be secured and the work pushed along to a successful termination.

Development of sufficient interest is therefore fundamental and the main object

of this appeal is to develop such an interest. It is hoped that at an early date expressions of opinion from some of the leading textile manufacturing and dyestuff associations may be published.

It is recognized, of course, that some dyestuff dealers and manufacturers who sell practically the same articles in competition with each other under different names and in varying strengths might object to standard tests which would at once classify their products, but the good of the majority ought to prevail.

Expressions of opinion from representatives of textile manufacturing concerns and various color interests will be welcomed by the editors of the AMERICAN DYESTUFF REPORTER.

***H**ERE is a suggestion to dyestuff consuming and manufacturing interests which is well worth careful consideration. The importance of the general subject of standard tests for fastness has long been recognized, but for one reason or another no concerted movement in this direction has been inaugurated. Publicity and a general discussion of the subject are prerequisites to any constructive action and, as Professor Olney suggests, **The Reporter** will be glad to co-operate in any such movement to the extent of its ability.*

Production of Even Dyeings on Cotton Warps

Necessity of Care in Preparatory Processes—Errors of Process as a Source of Trouble—Importance of Care in Selecting Dyes—Troubles Arising During Drying and Finishing

By WALTER F. HASKELL

Dyer, Dana Warp Company, Westbrook, Me.

THE writer's experience as a dyer, like that of many other men in the different branches of the textile industry, has been intensive rather than extensive. He has spent much time and effort seeking the best solution of certain dyeing problems which he has met repeatedly in his daily work, while others of equal difficulty and importance have not been brought to his attention so frequently or perhaps not at all. He will endeavor, however, to avoid as much as possible any consequent narrow treatment of his subject.

Even or level dyeings are, of course, very desirable and many times absolutely necessary in most branches of dyeing. The warp dyer would prefer to see his warps with every inch of every thread of exactly the same shade, but many times he is forced to content himself with work only sufficiently good in that respect to reduce the number of "seconds" from this cause to a low minimum. There are many difficulties in his path and he can hardly expect to avoid them all successfully with every set of warps he dyes.

PREPARING THE WARPS

The preparation of warps for dyeing calls for careful work. Twisted or rolled places or any compression of the yarn should be avoided so far as possible. Whenever strings have to be tied through loops of the warps, as in doubling, those loops must be carefully dyed by hand to the proper shade. It is surprising how large a spot of a light shade or even white a comparatively light confinement of a warp will produce.

It is customary to wet warps thoroughly in boiling water before dyeing, although many heavy shades can be dyed successfully without this treatment. For medium and light shades the preliminary wetting out cannot be omitted, and it is furthermore necessary that all portions of yarn be equally moist as they enter the dye bath. It is, however, the writer's opinion that prolonged boiling with soda or turkey-red oil or similar oils is of little value in producing even shades.

FEEDING THE DYE BATH

Errors in the dyeing process itself are the most prolific source of uneven shades. Most methods of warp dyeing on a large scale require a stock liquor to be fed into the dye bath regularly or systematically during the passage of the warps in rope form through the

dye bath either once or twice or more times. This passage may require from ten or fifteen minutes up to two or three hours or more, according to the kind of machine used, the size and length of the set of warps, the shade to be dyed, etc. During this time the bath must be kept constantly at the proper temperature, and its strength and volume must not be allowed to change except in a controlled and systematic manner. The dye must be kept in good solution or reduction, if a vat color, and the required strength of alkalinity or acidity must be preserved. It is, of course, a first essential that the dyestuff be thoroughly dissolved or reduced in the stock liquor. This is not always easily accomplished, owing many times to the very high concentration of such liquors.

The feeding of the stock liquor must be so planned as to produce, as a final result, the same depth of shade on all portions of the warp. Under differing circumstances there is wide variation in the best method to follow. Sometimes the dye can all be added to the bath at the start of each passage and none fed while the warps are running. At other times about as much must be fed as is put in before starting to run the warps, and sometimes the dye has to be nearly all fed while running. Conditions vary so that no definite rule can be given, but in general the longer and heavier the warp the more of the dye must be fed and the less put in at the start.

DYEING WITH MIXED COLORS

When dyeing with two or more dyestuffs mixed, care must be taken to select those with as nearly as possible the same rate of exhaustion. This is particularly important with warps which require considerable time to pass through the dye bath. If two colors are used which exhaust at greatly different rates, the slow exhausting color will gradually accumulate in the dye bath and its shade will predominate more and more in the shade dyed on the warps.

If an even number of passages or runs are made, this variation will frequently compensate itself because of the fact that the first end of the warp during the first run becomes the last end of the second run. For example, in dyeing a green with a mixture of sulphur yellow and blue, the yellow will usually exhaust more rapidly than the blue, so that the green will slowly become bluer during the first passage of the warp owing to the gradual accumulation of the

blue in the bath. The same thing will occur during the second passage, but the warp will be traveling in the opposite direction, so that, while the bath continues to become more and more blue, the warp, as it enters the bath, is constantly yellower and the sum of the two shades will give a fairly even green from one end of the warp to the other. It is, however, better to avoid the danger of unevenness from this cause so far as possible by care in the selection of dyestuffs for compound shades.

SQUEEZING AND RINSING

Good squeeze rolls as the warp finally leaves the dye bath are needed. Any portion of the yarn which is not properly squeezed out is very apt to make its presence known later by dark streaks or bronzed places in the finished dyeings, unless the yarn is washed very soon after dyeing. It is very desirable, if not absolutely essential, in dyeing sulphur black and many sulphur colors and some vat colors that the warps pass from the squeeze rolls out of the dye bath directly into a wash water, with perhaps a few seconds' interval for oxidation.

It is obvious that the motion of the warps through the dye bath should be continuous and at a constant rate of speed without interruption for more than a few seconds at a time. The dyehouse should be given a very reliable source of power. Machines must be of substantial construction and kept in good repair. Good belts must be provided, and water and steam must be kept away from them so far as possible.

After the warps have been successfully dyed it fre-

quently happens that their appearance becomes seriously impaired by the operation of drying, especially if the so-called "can dryer" is used. A warp is usually so thick compared with ordinary cotton piece goods that it must be kept in contact with the steam-heated cylinders for a much longer time to become thoroughly dry. During this time, while the water is becoming gradually vaporized and driven off, the interior of the warp is subjected to the action of this hot water for several minutes. There is a tendency for more or less of the dyestuff to become dissolved and carried to the outer portion of the warp to be deposited there when the water finally passes off as vapor. This produces a streaky, cloudy appearance which is many times very objectionable. Frequently this deposit is readily removed by sizing or a light washing, but with some dyestuffs it is very difficult to overcome. It may be prevented to a great degree by squeezing the warps as dry as possible at the last wash and by the well-known expedient of making the last run through a bath containing salt or Glauber's salt.

Many dyestuffs give shades which are sensitive to heat and which are therefore apt to appear uneven immediately after drying. This change of shade is usually only temporary and disappears after a few hours, when the yarn becomes well cooled down.

Good dyeing of any sort cannot be done carelessly or without attention to every essential detail, and the writer has attempted simply to discuss briefly some of the things which he has been obliged to consider in his attempt to consistently produce good satisfactory shades in his line of work.

Dyeing Woolen Goods With Acid Colors

Methods of Overcoming Unevenness—Uses of Glauber Salt—Dyeing with a Combination of Colors—Neutral Dyeing Colors—No Excuse for Lack of Fastness to Light

By G. E. TEMPLETON

Superintendent of Dyeing, Brown Woolen Mills, Ltd., Kingsville, Ont.

AS is well known, wool possesses a natural affinity for acid colors, and in most cases—depending entirely on the depth of shade—2 to 4 per cent of color will produce a full shade when dyed in an acid bath.

One of the quickest and most used methods of dyeing woolens with acid colors is to charge the dye bath with the requisite amount of dyestuff and from 10 to 20 per cent of Glauber salt crystals and 2 to 4 per cent sulphuric acid. The material may be entered at a boil, the bath being practically exhausted after one-half to three-quarters of an hour's boiling.

Most level results, however, may not be produced

in this way. To overcome any unevenness, the goods should be entered with the bath at from 50 to 70 deg. Fahr. Bring the bath gradually to a boil in from thirty to forty-five minutes. Continue boiling for at least half an hour, longer if necessary.

THOROUGH BOILING NEEDED

The former method works out without any trouble where types that are easily leveling are used, or with types that do not become "fixed" except at or near a boiling point. A good boiling is, in nearly every case, an essential where acid dyes are used, for in most in-

stances it exerts a leveling tendency. Familiarity with the types one is using is a great asset; in fact, a dyer ought never to attempt to dye a batch of goods with a dyestuff with which he is unfamiliar. He ought first to experiment carefully in order to determine for himself its dyeing properties.

USES OF GLAUBER SALT

Sulphate of soda, or Glauber salt, also tends to produce level dyeings. As related by J. Merritt Mathews, Ph.D., Glauber salt used in the dyebath may exert an influence in several ways, i. e.:

1. In mechanically retarding interaction between the color and the fiber.

2. In chemically retarding the liberation of the color acid from the dye salt.

3. In affecting the solubility of the dyestuff in solution.

Another use of Glauber salt, and one that is oftentimes useful, is where goods dyed in an acid bath come up uneven. In such cases an excess amount of Glauber salt may be added to the bath and, after a continued boiling, it will be seen to have stripped the color to an appreciable extent. When this has been accomplished, the same suspended color may be re-fixed on the fiber by the judicious use of acid. The bath should be allowed to cool off before adding the acid, and then only in a diluted form.

USE OF SODIUM BISULPHATE

In the place of Glauber salt and acid, sodium bisulphate may be used. As the material is brought to the boil the sodium bisulphate becomes gradually dissociated in the bath into sodium sulphate and acid, and its action is therefore more gradual than with the use of a free acid.

Numerous colors dye best by using from 5 to 10 per cent of acetic acid and, after a sufficient boiling, exhausting the bath with an addition of from 1 to 2 per cent of sulphuric acid, added in well-diluted form, and boiling for from fifteen to thirty minutes.

DYEING WITH A COMBINATION OF COLORS

Where a combination of colors is used, excellent results may often be obtained by starting the bath cold and using 5 to 10 per cent acetic acid and 1 per cent sulphuric acid. This method works well where one color has a tendency to go on ahead of another or, in other words, where the dye is precipitated from aqueous solution by sulphuric acid while not being so affected by acetic acid.

Formic acid may be used in place of either of the above-mentioned methods, as its action holds an intermediate place between that of sulphuric and acetic acid.

NEUTRAL DYEING COLORS

There are also types producing excellent shades

which dye neutral, and are designated as neutral dyeing colors. Where such dyes are used in an acid bath they should be dyed with the use of acetate of ammonia, which has a tendency to retard the dyeing. The acid only becomes dissociated after a continued boiling, the ammonia passing off with the vapor, thereby liberating the acid in the dye bath. In order to exhaust the bath, a small percentage of acetic acid may be added to the bath if required, which will develop the shade completely. Sulphate of ammonia may also be used, and its application is similar to that of acetate of ammonia.

There are many kinds of cloth, however, which could not be dyed by either of these methods, owing to the length of time required in the operation.

Where cloths come from the dye bath clouded or streaked a dyer can, as a rule, tell whether the fault is in the dyeing or elsewhere. Much trouble will be eliminated by "knowing" that the material to be dyed has been thoroughly cleansed, and not merely taking someone's word for it. With the judicious use of level dyeing acid colors of good fastness to light, the dyer need experience little or no difficulty in producing results of a highly satisfactory nature—particularly to-day, when dyestuff conditions are so far ahead of those of a few short years ago.

ACID COLORS READILY AVAILABLE

There is readily available, at the present time, a sufficient range of American-made acid colors which meet the various fastness requirements to enable the dyer to obtain practically any shade he may be called upon to produce. The regrettable fact is that so many colors are used which do not possess the fastness to light which they should. It is not fair to the public, the dye manufacturer or to the mill. While conditions in the recent past have not enabled the dyer to deliver goods as he should, that day is now definitely gone and, we trust, gone forever. Dyes of as high a standard as were ever manufactured by Germany are now manufactured and obtainable in quantity from American dyestuff concerns and the dyer himself is to blame if he does not utilize them to the fullest advantage.

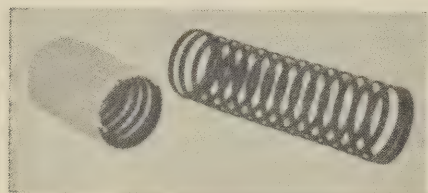
We shall welcome the day when the public, wholesale houses and clothing manufacturers insist upon fabrics intended for outdoor wear being fast to light, street dirt, etc. There is no excuse to-day for mills turning out fabrics that are unsatisfactory in this respect. The dyer should understand thoroughly every type which he uses, the qualities which each type possesses, and the use for which each is best adapted. If he will take the trouble to assure himself on these points and then use his information with ordinary care and intelligence he will seldom fail to achieve results thoroughly satisfactory to himself and to his mill.

A Brief Description of the Dyeing of Yarns in the Wound Form

By B. S. PHETTEPLACE

Franklin Process Company, Providence, R. I.

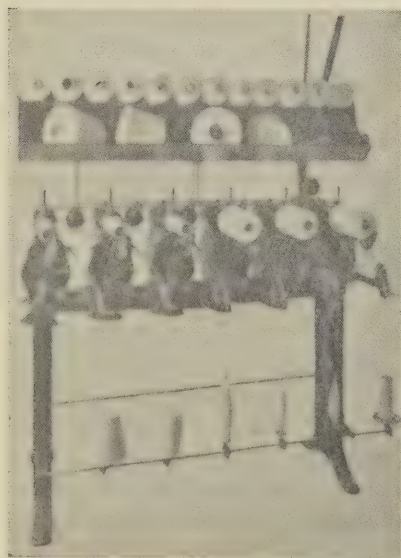
WHILE the dyeing of yarns in the wound form is not a recent discovery, the great strides which have been made in its development in the past few years have made it the most practical and economical method of dyeing in most cases. There is a good reason why a skein of yarn should not be made unless absolutely necessary. When you make a skein of yarn you take it from a convenient form and put in a very inconvenient form, dye or bleach it and put it back into a convenient form.



Franklin Parallel Tubes

entirely, thus saving labor, time, and waste. Similarly, as electricity has taken the place of the kerosene lamp, so is the Franklin method of dyeing in the wound form, as this method is called, taking the place of skein dyeing. Any cotton yarn that can be wound, from the finest single to cable cord, can be perfectly dyed in the wound form.

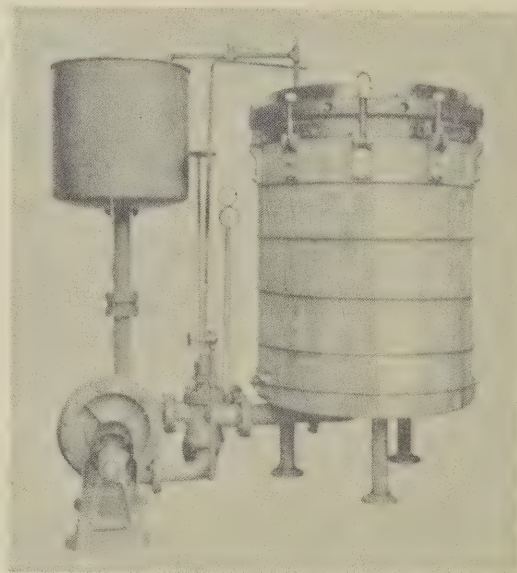
The white yarn in the form of a cone, tube, cop, hobbins, or quill, is wound on a Franklin parallel tube over which is put a knitted cover the same length as the tube. The tubes are made in three lengths, 3, 6 and 9 inches, as are the knitted covers—to suit the count of yarn and the conditions of rewinding. Yarn numbering 30/1 and finer is put on a 3-inch tube, there being no drag when taking the yarn off the dyed package over end, and, when rotating it, it is easier to rotate only one-half pound which is the weight of the dyed package. Yarns heavier than this are put on a 6-inch tube, while for twine, jute, cotton roving, and cable cord, a 9-inch tube is sometimes more desirable. The yarn is wound onto the tubes by a No. 50 Universal winder. The 3-inch tubes are usually wound to a diameter of $4\frac{1}{4}$ inches, while



Universal Winder

the 6 and 9-inch tubes are made $4\frac{1}{2}$ inches. The winding is a very simply and inexpensive operation as the reader can see.

The dyeing machine consists, principally, of an expansion tank at the left, a pump, pulley and motor, water supply valve and piping, steam supply valve and piping, thermometer, four-way valves controlling the circulation of the liquor, two gauges showing the pressure as well as the direction in which the liquor is flowing, an overflow pipe, the dye tank which has a false bottom with perforated vertical spindles extending to the cover, and a sampling device which enables one at any time during



Franklin Dyeing Machine with Wood Kier

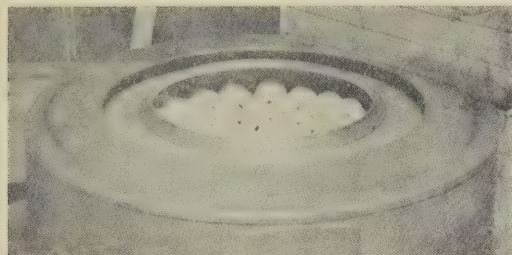
the operation to examine the progress of dyeing.

This machine is easily and quickly loaded by putting the wound packages on the vertical spindles and when this operation is complete, are held in place by a clamp on the top of each spindle. The cover is put into place and held securely by bolts.

For dyeing cotton yarn the machine is filled with water and the pump started to wet out the yarn. If scouring of the yarn is necessary soda ash or soluble oil may be employed. This is put into the expansion tank in solution and is forced by the pump from the outside of the package to the inside. By reversing the valve the liquor then flows from the inside of the package to the outside. After boiling out this liquor may be run off, or in dyeing some colors, the same liquor can be used in dyeing. The dye-stuff is boiled up in a barrel or other receptacle and put into the expansion tank as in scouring. For dark shades of direct colors $3\frac{1}{2}$ to 4 hours is ample time to wet out

or boil out and color the yarn. Any class of color that is made can be used in these machines, but the color must be gotten into solution before using.

After dyeing the machine is unloaded. A pair of tongs being used to grip the bottom package on the spindle, removing all packages on that spindle at once. These packages or tubes of yarn are then placed in a basket



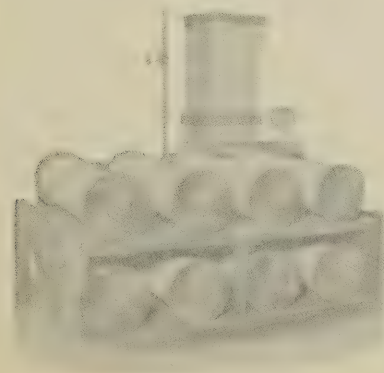
Basket Extractor

extractor and extracted for about ten minutes. Next, they are placed in trays and these put in a dryer. The time for drying takes about eight hours.

WORSTED PACKAGE DYEING

Single or ply worsted yarns are dyed perfectly by this process that could not possibly be dyed in the skein. The machines are built in size from 6 to 1,000 pounds and can be overloaded up to 25 per cent of this capacity or can be used for a quantity, down to 50 per cent. The kier is made of cypress and the parallel tubes of an acid resisting metal. Any one can see in dyeing yarn by this method where only 1 gallon of liquor is used to 1 pound of yarn as against 12 gallons in some cases, the process would be economical. The amount of steam used up in a dye-house is very large and is an item that it would pay to watch carefully.

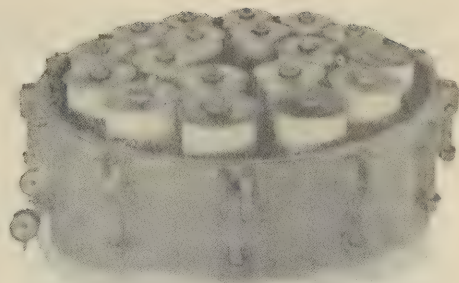
A new way of doing things always opens up opportunities for further improvement. Take, for instance, the manufacturing of worsted cloth by using dyed single yarn. If manufacturers were not fitted up to dye raw stock or in the top, you would never consider putting dyed single yarns into goods. With this



Jackspool Dryer

process available, fancies of practically any kind that can be woven can be manufactured without any difficulty from the dyeing, for you can color any count of single

yarn in a Franklin dyeing machine that can be wound. The yarn has no chance to shrink or felt in the dyeing, is not altered in respect to count or twist and on account of pumping the hot liquor through the yarn in the wound form it comes out stronger than before.

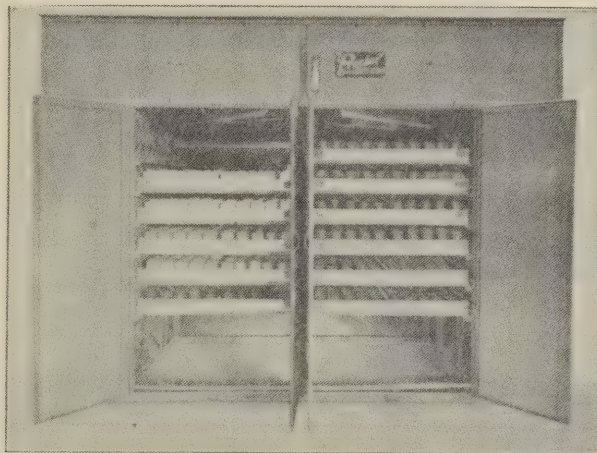


Jackspool Machine Open

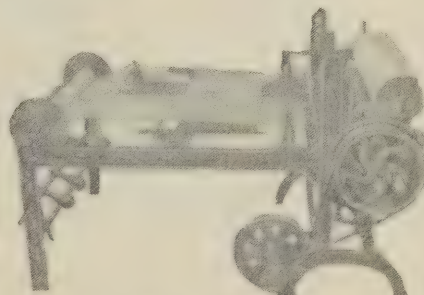
JACKSPOOL DYEING

The dyeing of worsted yarns, single or ply and woolen yarn by the jackspool method is far superior to the skein dyeing of the same. The yarn being received on a wooden jackspool or beam is wound onto a metal jackspool which has a perforated barrel. The metal spool is made of a metal permissible with the liquor employed in dyeing. This machine is made on the same principle as the package dyeing machine except the perforated jackspool is employed instead of perforated spindles. After dyeing, the spools are transferred to a drier where warm air is forced through them by means of a pressure blower and heater.

This operation both extracts and dries the yarn in from 2½ to 4 hours. It is far superior to any other method



Package Dryer

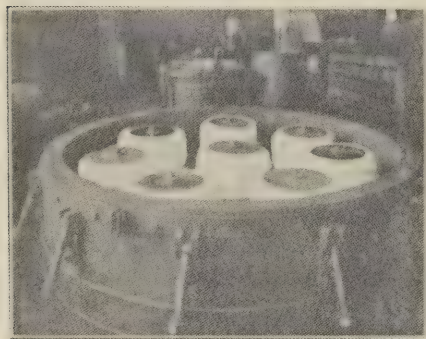


Jackspool Winder

of extracting and drying. After drying, the yarn is wound back on the wooden jackspool and is ready for use in the dresser.

The dyeing of tops by this process is far in advance of the older forms of top dyeing. A false bottom in the

machine provides for a compartment B B beneath the work. A perforated spindle rises above the tops and is connected with a pipe through the real bottom to the pump. The second pipe also leads from the pump to the false bottom but not into the machine. These two pipes



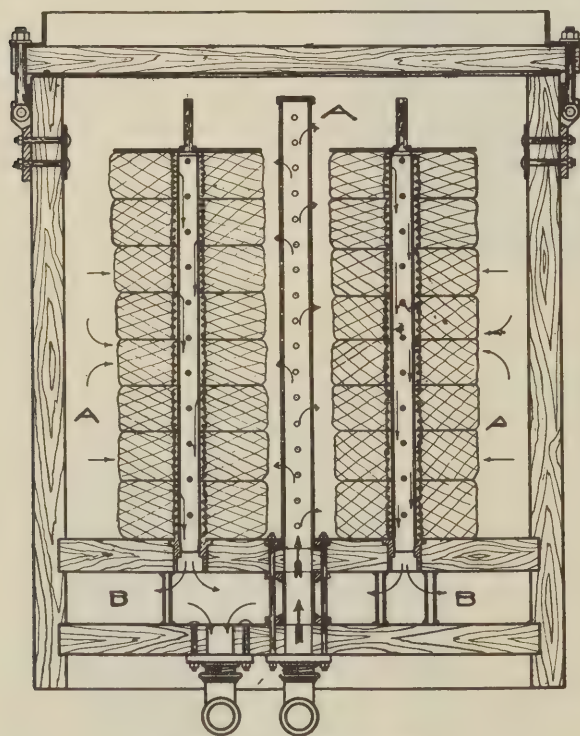
Top Dyeing Machine Open

are connected to the pump by a four-way valve used to direct the flow of the liquor. Upon starting the pump the liquor will flow up the center pipe dividing into several streams by flowing out through the perforations. A pressure will be exerted inside the kier, but outside of the tops forcing the liquor through the tops to the perforations in the tubes within the several piles of tops. This causes a pressure of about 7 pounds per square inch in A A and no pressure in B B. Upon reversing the valve, the flow of liquor is reversed. The pressure is then developed in B B with no pressure in A A. In neither case is the liquor sucked, but is always being forced by the pump. As a matter of fact,

of the tops collapse and seize the spindle, thus preventing the lower tops from being compressed to the same density as the upper ones. To help overcome this difficulty, it is common practice to pull a handful of stock from the inside of the top and wind it around the outside. This helps the dyer out of his difficulty, but does not make better work in finishing. Tops wound on the Franklin tube do not collapse and seize the spindle, thus allowing uniform compression of the column.

If the manufacturer wishes to spin his dyed yarns from dyed stock by taking advantage of a Franklin top dyeing machine, the tops will be dyed with so little disturbance that recombining is not necessary. With this type of a machine available, worsted should never be dyed in the slubbing under any circumstances, as the process is most wasteful as compared to the dyeing of the wound top.

By using these various methods of dyeing it is obvious that the savings over the method of skein dyeing is wonderful. The short dye bath requires less chemicals and dyestuff. The employees are not handicapped by an atmosphere saturated with steam. The floor space is a large item, but more especially because of abnormal conditions of building material. As there is practically no waste of yarn when delivered on the Franklin tube this item alone would almost pay for the installation of this system.



Inside of Top Machine

boiling liquor cannot be sucked. It is apparent that if the column of tops on a spindle is not compressed uniformly, uneven dyeing will result as more dye liquor will penetrate the softer top than the hard. When ordinary tops are placed on a spindle and compressed, the center

SPINNING ARTIFICIAL SILK WASTE

A process has recently been patented in this country for spinning artificial silk waste. The inventor in his description states that the use of artificial silk waste has been greatly restricted by the fact that the slippery nature of the fiber prevents its being spun finer than 24s cotton count. He claims that his process enables artificial silk waste to be spun much finer.

This is accomplished by adding to artificial silk waste 18 per cent of real silk waste, subsequently mixing and intertwining the fibers one with the other and then treating the whole with 5 per cent of lard oil. This mixture is then spun.

The natural silk waste must nearly approximate the artificial silk waste in luster so that the small addition of real silk waste to the artificial silk waste does not appreciably detract from the luster of the finished yarn.

After the yarn has been manufactured a very unique effect may be obtained by coloring the yarn with a dye that acts on only one of the two materials. In this way one of the fibers will retain its natural color, giving the yarn a mixed appearance. On the other hand, the yarn may be treated with what is known as a union dye to give a solid color.

By mixing the artificial silk waste with the real silk waste it is possible to spin the artificial silk waste to a much finer thread than if the same had been used alone.

Bleaching of Textile Fibrous Materials by Means of Oxygen Compounds

Chlorine Compounds Unsited for Bleaching Animal Fibers—Mixtures Containing Animal Fibers Should Be Bleached with Oxygen-Liberating Compounds—Peroxides of Sodium and Hydrogen and Sodium Perborate Best Suited for This Purpose—Processes for Bleaching Material Containing Wool and Silk

By WALTER E. HADLEY

THE art of bleaching has been practised for many years, and for a long period of time the universal bleaching agent for cotton material was chlorine, and for wool and silk, sulphur dioxide. Of late years the use of oxygen-bearing compounds has come into vogue, and they possess real value with many classes of textile fibers.

It is the object of this short article to outline in brief the various types of oxygen-bearing compounds suitable for bleaching, as well as the different fibers particularly adapted to their use.

CHLORINE UNSUITED TO WOOL OR SILK

It is well known that the bleaching action of chlorine compounds is due to the decomposition of water, by which means oxygen is liberated, and it is the nascent oxygen which oxidizes the coloring matters upon and within the material being treated, and thus accomplishes the bleaching. It is obvious that any substance which will, of itself or in combination with other compounds, exert a deleterious action upon the textile material being treated cannot be advantageously employed. Thus, the chlorine compounds which are so successfully used for the bleaching of cotton and linen materials are wholly unsited for the whitening of woolen or silk fabrics, due to the chlorinating action upon the wool. For a similar reason chlorine cannot be used for the bleaching of silk.

The use of chlorine compounds is therefore limited to cotton and linen material, whereas it is often absolutely necessary to bleach material composed of two or more types of textile fibers, as will be seen from the following.

The so-called silk stockings do not consist wholly of silk, but are usually made with a silk leg and cotton knees and feet. An all-cotton sock can be readily and cheaply bleached by means of chlorine compounds, but the presence of silk precludes the use of chlorine. The writer once saw a lot of cotton-silk stockings which had been treated in a chlorine bleach bath, under the impression that the silk was artificial silk, and the lot was then only suitable to be used for dyed stock of a dark shade.

Again, a sock may be manufactured from a thread formed by twisting wool and cotton fibers, wool and silk, wool, silk and cotton, or any other combination of fibers, the presence of wool and silk preventing the use of chlorine.

Thus many types of textile materials, being composed of fibers which are entirely different in their composition, must be carefully considered in relation to their behavior with chlorine compounds.

Inasmuch as nascent oxygen brings about the bleaching action, it must be conceded that the ideal compound is one which will liberate nascent oxygen directly and not form any objectionable compound within the bleach bath or upon the textile material being treated. It is this function possessed by the oxygen-bearing compounds which renders them extremely valuable as bleaching agents.

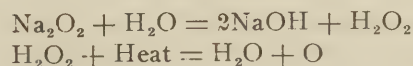
While potassium permanganate and potassium bichromate possess bleaching properties, the only oxygen-bearing compounds which will be considered will be sodium peroxide, hydrogen peroxide and sodium perborate.

Sodium Peroxide (Na_2O_2).—Sodium peroxide is prepared from metallic sodium at a temperature of 300 deg. Cent. by treating with dry air, free from carbon dioxide gas. It is a yellowish-white powder and is very hygroscopic in its nature. It is packed and shipped in tins or drums, and must be protected from moisture at all times. If the powder comes in close proximity with easily inflammable material, such as cotton and wool, there is grave danger of same being ignited by the sodium peroxide.

Hydrogen Peroxide (H_2O_2).—Hydrogen peroxide is prepared from sodium peroxide or from barium peroxide. It is marketed in different strengths known as 10 volume up to 30 volume. The value of the hydrogen peroxide solution lies in the amount of available oxygen contained in same.

Sodium Perborate ($\text{NaBO}_3\cdot 4\text{H}_2\text{O}$).—Sodium perborate is an extremely stable compound, and when dissolved in water liberates hydrogen peroxide. It is prepared by the proper treatment of sodium peroxide with boric acid.

When sodium peroxide is dissolved in water a large amount of heat is generated, the solution is decidedly alkaline, and strong effervescence occurs, due to the decomposition of the compound, with subsequent liberation of oxygen.



In order to be of value for bleaching purposes the decomposition of the oxygen-bearing compound must

be so controlled that the nascent oxygen will be steadily and slowly liberated throughout the entire material being bleached. The liberation of this nascent oxygen is hastened or retarded, at the will of the operator, by the proper control of the alkalinity and temperature of the bleach bath, an acid condition retarding and an alkaline condition hastening the liberation of oxygen. Furthermore, a low temperature retards and a high temperature accelerates the flow of oxygen.

A bleach bath made from sodium peroxide may be prepared by dissolving the required amount of sodium peroxide in a dilute acid bath containing a definite amount of oil of vitriol, and then brought to the proper degree of alkalinity for bleaching.

A hydrogen peroxide bleach bath is somewhat easier of preparation, due to the fact that the hydrogen peroxide is already in solution in an acid medium and therefore only needs to be diluted to the proper strength with water and brought to the required alkalinity.

Sodium perborate, being more expensive, finds its chief use in laundry compounds and special mixtures, and not for bleaching in general.

The oxygen compounds find wide application in the bleaching of the better grades of cotton material, where softness and elasticity are essential requirements, and they are unquestionably the ideal compounds for woolen and worsted materials, silk, artificial silk and all combination of these fibers. The oxygen compounds are used for bleaching most of the straw braid used in this country. In bleaching straw braid it is customary to give a smoke in the fumes of sulphur dioxide gas.

The oxygen bleach when properly applied produces a clear, pleasing, permanent white, the material possessing remarkable softness, elasticity and strength.

METHOD OF BLEACHING COTTON WITH OXYGEN COMPOUNDS

Certain types of cotton material may be satisfactorily bleached directly in the peroxide bath, without a preliminary boil-off, but the writer is of the opinion that better results are obtained if the material is first given a thorough cleansing before bleaching.

A satisfactory peroxide bath may be prepared as follows for the bleaching of cotton material: For 100 gallons of bleach liquor use 2 pounds sodium peroxide, $2\frac{3}{4}$ pounds oil of vitriol and 4 pounds of silicate of soda. The oil of vitriol is first thoroughly mixed with water and the sodium peroxide added slowly, with constant stirring, until the bath reacts neutral to litmus paper. The sodium silicate is then somewhat diluted and added to the bath, which will then react quite strongly alkaline to litmus paper.

The cotton material is entered and the temperature of the bath raised to just under a boil, at which temperature it should be maintained for one hour.

The bleaching strength of the bath depends upon the amount of available oxygen present, and this is readily determined by simple titration of the bleach bath by means of tenth normal potassium permanganate solution, in the presence of sulphuric acid.

BLEACHING ANIMAL FIBERS

Woolen and worsted material, which was formerly bleached by suspending from poles and allowing the fumes of sulphur dioxide gas to come in contact with same, can now be bleached to a beautiful shade by immersion in a properly prepared oxygen bath. The material should first be thoroughly cleansed by treatment in a soap bath containing either potassium or sodium carbonate. The bleach bath may be prepared as follows for 100 gallons of liquor: 4 pounds sodium peroxide, $5\frac{1}{2}$ pounds oil of vitriol and 2 pounds trisodium phosphate.

The temperature of the bath should not be allowed to rise above 140 deg. Fahr., and the bleaching may progress until the desired shade is obtained.

The used bath may be replenished to the proper strength and used for an extended period of time. If allowed to stand between periods of use, the bath must be rendered slightly acid with oil of vitriol to prevent the decomposition of the bath.

Silk is bleached to a beautiful shade by means of oxygen compounds, a somewhat stronger bath being used than in the case of wool and the alkalinity being obtained with sodium silicate. The temperature may also be materially increased over that used for wool.

Material which has been bleached with oxygen compounds possesses remarkable softness, elasticity, brilliancy, strength and life, and a permanent white is obtained.

When bleaching with oxygen compounds care must be taken regarding the receptacles used for the bleach bath. It is generally considered that the best results are obtained when the bleaching is carried out in wooden vats built with a false bottom, beneath which is a lead pipe coil for heating with steam. The material to be bleached is carefully and evenly packed, not too tightly, within the vat and the entire lot held beneath the surface of the liquor by means of a wooden framework composed of slats.

When bleaching with chlorine compounds a large volume of bleach liquor may be used with a comparatively small amount of actual chlorine in evidence, and the material if allowed to remain in contact with the chlorine for a sufficient length of time will be successfully bleached. An entirely different principle prevails in the use of oxygen-bearing compounds, inasmuch as the volume of liquor in relation to the goods must be kept as low as possible. In other words, a bleach bath prepared from oxygen-bearing compounds must possess the same percentage of available oxygen regardless of the quantity of material being bleached.

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL

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CONCERNING OURSELVES

One month ago the initial issue of the Technical Supplement of the AMERICAN DYESTUFF REPORTER made its appearance. At that time we warned our readers that the first number was little more than a shell—a skeleton to which the blood and tissue remained to be supplied before the organism could be called complete. And we promised such completion with the present number.

How well we have fulfilled our promise we leave for our readers to determine. Personally, we are not satisfied—but we are encouraged. An examination of the contents of this issue as opposed to that of last month will satisfy the most critical that we have made notable progress. If the standard can be correspondingly raised with each successive issue it will not be long before we shall have a journal of the dyestuff field second to none in the world.

And this is the goal toward which we have bent our course. Nothing less will completely satisfy us. Toward the accomplishment of this end we shall exert our every effort and we earnestly bespeak from our many friends a continuance of the interested co-operation which has made possible the improvements shown in the present issue over that of last month.

COLOR CHEMISTS IN THE WAR

The remarkable work done by the Chemical Warfare Service in the late war has been widely commented upon both here and abroad. It is generally agreed that the activities of this section had, by the closing days of the war, placed the United States in a position where her deliveries of toxic and neutralizing gases had become a paramount factor—a factor so potent that it was, perhaps, a realization of this impending flood as much as any other one consideration which caused Germany to recognize the uselessness of further prolonging the struggle.

The part played by our textile and color chemists in this remarkable achievement has, however, escaped with comparatively slight recognition. As a matter of fact, it was to them more than to any other single group of chemists that the remarkable success of our Chemical Warfare Service was attributable. Their achievements in this field are forceful examples of what may be expected of them in any national crisis where the research chemist may conceivably play a part; they constitute equally powerful arguments for the enactment of adequate protective legislation, for a manufacturing dyestuff industry is, as has been repeatedly pointed out by The REPORTER, the only true foundation for the maintenance of a national army of research chemists.

We think it would be most fitting of Congress to take some official recognition of the services to the nation of the textile and color chemists of the Chemical Warfare Service. Medals or other decorations are, perhaps, poor weapons with which to combat the H. C. L., but they do furnish the recipients with some tangible evidence of the nation's gratitude. In a statement published elsewhere in these pages, which he has entitled "An Appreciation," Wm. M. Wood, president of the American Woolen Company, speaks of the debt which the textile manufacturers owe to the textile and color chemists for their speedy and ample production of dyestuffs. We feel that it would be equally graceful and appropriate for Congress to express official appreciation of their work in the Chemical Warfare Service.

"MEN OF MARK"

One of the pages in this issue is entitled, "Men of Mark in the Dyestuff Field." It is our intention to make this a monthly feature. The subject of this month's page is Wm. D. Livermore, Chief Chemist of the American Woolen Company, a gentleman who needs no introduction to the textile dyeing fraternity of America. Each month we hope to publish the photograph and a brief biography of some person whose position or accomplishments in the technical side of dyestuff application or manufacture have made him an outstanding figure. We trust that our readers will find this series interesting and, incidentally, that it may occasion no "pique" to any who may feel that they or their friends have been slighted. We cannot deal with more than one subject at a time, but there are many months to come and the publishers will be most grateful if our readers will interest themselves sufficiently to suggest suitable candidates for enrollment in "Men of Mark."

A DYERS' FORUM

On nearly every occasion when the publisher of The REPORTER has fallen into conversation with a dyer he has learned of some difficulty which the dyer has encountered at some stage of his career and which he has solved by more or less unique methods. Oftentimes the solutions of these personal problems are regarded as "secrets"—the dyer's "stock in trade," as it were.

We wonder if this is not short-sighted policy. If it were possible for all dyers to get together occasionally

and indulge in a free interchange of confidences, would not the general standard of the profession be materially raised? And would not even the most experienced be able to glean from the experiences of others a sum total of knowledge far in excess of the value to them of what they might individually divulge? Personally, we believe this to be the case—and we should be glad to assist in proving the fact.

It is, of course, physically impossible for any considerable percentage of the dyers of America to congregate in any one place at frequent intervals, but there is no reason why the pages of a widely-read technical journal—such as this section of *The Reporter*—cannot be made to serve practically the same purpose. If those of our readers who have discovered new ways of doing things or better ways of doing old things—anything, in fact, which would be interesting or helpful to their brothers—would write us of their experiences we could publish them to the obvious advantage of the trade at large. And we feel confident that those who benefited from these disclosures would, in turn, feel impelled to pass on some words of wisdom of their own.

The *Reporter* would be glad to establish such a department if we felt that sufficient interest would be evidenced by our readers to insure its maintenance as a real "Dyers' Forum." In it difficulties which had been encountered might be aired for popular discussion. Someone might have found a way to solve the very problem which is troubling you and, what is more, he might be willing to explain it. We imagine that, in some cases, dyers are reluctant to write for publication because they feel that their literary style is not quite "up to the mark." This is very false modesty indeed. In the first place, it is a poor excuse for withholding something which might be of any real benefit to the profession and, in the second place, the editor would "smooth out" the English so that the grammar, at least, would pass muster. It's "what you say," not "how you say it," that counts in a technical journal.

We should greatly appreciate hearing from our readers what they think of this suggestion. We should be glad to do everything in our power to make it a success. We might offer a suitable prize for the best article or comment submitted each month. But the essential of success in a matter of this sort is real reader interest—a disposition to give and not merely to receive.

A DYESTUFF "PRIMER"

Not long ago, when the publisher was debating the advisability of establishing the monthly technical section of *The Reporter* we made opportunity to discuss the project with various gentlemen of our acquaintance whose positions in dyestuff circles lent weight to their several opinions. One of those whom we approached voiced the sentiment that we could only "rehash old stuff" and that everything about the application of dyestuffs which could be said *had been* said. We were somewhat disconcerted by his views, but the words of the next authority whose advice we sought served, in great part, to restore our optimism.

In substance, he said: "It is true that nearly everything of consequence which can be set down relative to the application of dyestuffs has been said or written by someone at some time or place. But it is quite erroneous to believe that all, or any considerable percentage, of those who are concerned with the coloring of textiles or other products know everything that has been said or written on the subject. As a matter of fact we in America are now in the process of training a vast army of young and inexperienced dyestuff chemists—men who have the very elementals of the profession yet to learn. Prior to the war we had a steady stream of well-trained color chemists immigrating to this country from Germany—from now on we must depend upon the youth of our own country, the products of our universities and textile schools. This great class, at least, can be vitally helped by such a journal as you propose to publish and in my opinion, even the oldest and most proficient of our color chemists will not infrequently find that their attention is redirected, through your columns, to some matter which, in the excitement of recent years, they had found time to forget."

We have accepted the view of the latter gentleman—largely, no doubt, because it coincided with our own. We offer it, however, as an excuse for any articles appearing in this or subsequent issues of *The Reporter* which may seem to some of our readers to be "old stuff." Remember that you were not always as wise as you now are and that there are many throughout the profession to whom a "dyestuff primer" is still an essential.

WHAT IS FASTNESS?

We Usually Think of It as a Chemical Quality, but
This Authority Suggests That It May
Be Purely Physical

A GENTLEMAN who has for many years been identified with the textile and color industries and who may unquestionably be ranked as an authority on questions relating to these subjects recently asked the publisher of *The Reporter* to define "fastness." Not wishing to air our lack of scientific knowledge, we declined the invitation. The gentleman in question thereupon handed us the little monograph which is reproduced below and asked us what was wrong with it. Frankly, we couldn't see anything wrong—in fact, it sounded quite all right. We asked his permission to publish it and invite our readers to criticise. To this suggestion he readily agreed but, for reasons of his own, requested that we withhold his name. We should like very much to know what our readers think—it seems to us that there is here much food for thought. The brief which he submitted follows:

FASTNESS

"The property of reflecting rays of light possessed by objects is evidently physical or mechanical. The definition of color given by the *International Encyclopedia* is

as follows: 'That quality of an object by which it emits, reflects or transmits certain rays of light and absorbs others, thus producing a specific effect on the eye, depending on the nature of the rays reaching the nervous element of the retina.'

"Thus while the stimulus, as far as the eye is concerned is photo-chemical, the condition in the object or surface which induces this stimulus is physical or mechanical.

"When an object ceases to transmit certain rays, and emits others—in other words, changes its color—this condition would seem to be induced by a change in its physical structure. This change may be caused by, among other things, treatment with certain chemicals, such as mordants and dyes.

"In dyeing with mordants and in indigo and vat dyeing, the effect is clearly that of a mechanical overlay, and the fiber is not penetrated by the dye as microscopical cross-sections will show. In mordant dyeing, it is the mordant which is physically changed or dyed, and not the fiber itself. If, therefore, color on fibers is a physical or mechanical condition whereby the striated structure of a cotton fiber, or the scale formation of a wool fiber, for instance, is changed by chemical treatment so as to alter the sequence of rays which it will absorb or transmit, then it should be amenable to accurate determination by microscopical examination and measurement. This leads at once to the determination of the permanence or impermanence of the changes in physical structure effected—or, in other words, the fastness of the color developed.

"If by subsequent treatment with water, alkali, acid, chlorine, by certain mechanical manipulation such as milling or fulling, or by exposure to light, the original physical structure can be restored, the color is not fast. If some one or more of these reagents or processes will restore the original structure, but not others, the color is moderately fast. If no recognized reagent or process will restore the original condition, then the changed physical characteristics of the fiber are permanent, and the color can be classified as fast."

DESIRABLE DYESTUFFS

Dyestuff Development Halted by the War—American Manufacturers Should Now Strive to Produce Original Colors

By PHILIP S. CLARKSON

AS the writer's experience with commercial dyestuffs covers quite a long period of time, the development of the various groups has been an interesting study. In 1887 commercial dyers made use largely of natural coloring matters. Logwood, fustic and hypernic were used for both cotton and wool and indigo was the standard blue. Synthetic alizarine was the red most largely used.

At that time, the synthetic dyestuffs comprised what are now known as the "ordinary acid colors," the true alizarine blues derived from alizarine with alizarine orange and brown, the "ordinary basic colors," and about ten of what were then known as substantive colors, the

dyestuffs which dyed cotton without a mordant, with common salt or some other assistant in the dyebath. One sulphur dyestuff had appeared under the name of Cachon de Lavel.

There was a steady advance from that time until the general disruption of affairs in 1914. The natural dyestuffs, so far as application to textiles was concerned, had been replaced to a great extent by the synthetic dyestuffs, either the same product made by synthetic processes, or coal tar products which would produce far superior results. The one-dip cotton colors developed into several hundred, the one sulphur dyestuff into more than one hundred, and synthetic indigo had replaced the natural product almost entirely in the American market.

These results had probably been brought about by the active competition among the manufacturers and the research chemists, at first between the English, French and German, and toward the end of the period, principally by competition among the Germans themselves. Great improvements were made in the qualities of the dyestuffs produced and the later products all showed great advances in the property of resistance to the action of injurious influences, such as light, washing, fulling, scouring, etc.

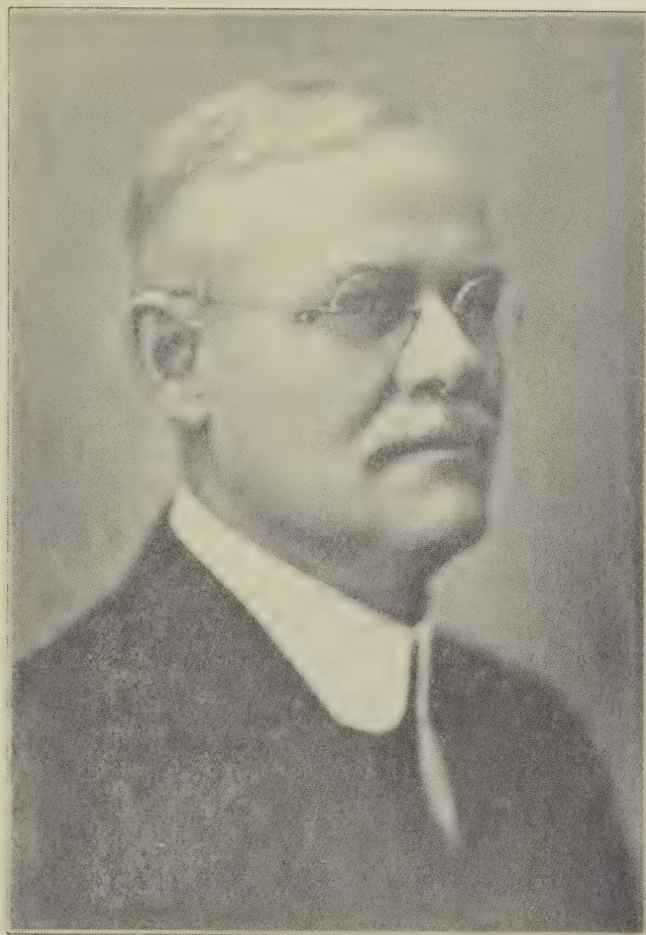
At this time the line of dyestuffs for the production of fast shades on wool was very satisfactory and some of the manufacturers devised fantastic tests, in most cases merely for the purpose of showing their products better than others. For cotton the showing was not so good. Fast colors could be obtained by the use of vat dyestuffs, but these were expensive and their application difficult. But the war interrupted the development of two most promising groups. The manufacturers were starting the production of one-dip cotton colors which were fast to light and also to reasonable washing, and the production of sulphur dyestuffs which did not require oxidation and showed the fully developed color at the end of the dyeing operation. Had it not been for the outbreak of the war, it is very probable that the number of these dyestuffs would have been so increased and the cost of production so reduced, that these would have been in general commercial use rather than the older products with their less desirable qualities.

ORIGINAL COLORS NEEDED

While the American dyestuff industry cannot be blamed for making anything that could be disposed of at the time, it cannot yet be said to have produced many original colors. But now it should turn aside from making the ordinary dyestuffs with fierce competition between the individual makers, and see if the development cannot be carried on from a more advanced stage, that is, where the foreign makers were compelled to stop. Attention should be turned to other lines in the chemical industry and an effort made to produce original colors possessing unusual qualities. When this time comes we shall cease to hear, "The color of that material is not fast, it is dyed with American dyestuff."

MEN OF MARK

in the Dyestuff Field



William D. Livermore
Chief Chemist
The American Woolen Co.

WILLIAM D. LIVERMORE was graduated as a chemist from the Massachusetts Institute of Technology in 1887 and found his first employment as second-hand in the dyehouse of the Silver Spring Bleachery & Dyeing Company, at Providence, R. I. It is an interesting commentary on the salaries of the time that Mr. Livermore's initial salary was \$600 a year, which was then considered quite munificent.

In March, 1889, he received through Professor Lewis M. Norton, of the Massachusetts Institute of Technology, an opportunity to go to Lawrence and establish a laboratory at the Washington mill. Chemical laboratories in connection with textile mills were rare institutions in those days, but the enterprise of William M. Wood, then treasurer of the Washington Mills Company, and the support of Francis H. Jealous, then agent, made it possible to inaugurate a system which gave assurance that the dyestuffs and chemicals received were those which were bought and that they were suitable for the purposes for which they were intended.

In 1899 Mr. Livermore received from Mr. Wood, executive head of the newly formed American Woolen Company, the office of chief chemist, which he still holds. In this capacity it has been possible for Mr. Livermore to expand the field of his operations and develop a chemical organization which has contributed greatly to the success of this greatest of America's woolen-manufacturing concerns.

Mr. Livermore holds the opinion that the chemist of a textile corporation, being a technical accessory to a manufacturing process which, basically at least, is non-chemical, does not have the opportunity to make the startling discoveries and introduce the revolutionary patents that are possible in certain other industries. He does believe, however, that textile chemists have a very great opportunity to assist in raising the standard of our American goods in respect to colors, finish, etc.

The Use of Steam Turbine Exhaust in the Woolen and Worsted Dyehouse

Conservation of Energy, and the Importance of Using Exhaust Steam in the Textile Plant—Use of Steam Turbine Exhaust Good Practice from Engineering Standpoint—Problem Entirely One of Control—Systems of Application

By HAROLD W. LEITCH
Chemical Engineer, Stillwater Worsted Mills

IN the operation of any manufacturing plant the conservation of energy is important. This applies to the saving of steam more than ever before on account of the high cost of fuel.

The textile mill as a rule uses some of the exhaust steam from engines and turbines in heating water for boilers, scouring, washing, etc. In cold weather some is used for heating the buildings. Many woolen and worsted dye houses are using exhaust steam successfully for all dyeing operations which are performed at atmospheric pressure;* on the other hand there are many establishments still using steam direct from the boilers.

TURBINE EXHAUST

From the engineering standpoint, using turbine exhaust for this work is good practice, because in using this power unit as a reducing value, only a small amount of heat is taken in producing power, which is thus derived at a very low cost. For example, saturated steam at a gauge pressure of 150 lb. may be reduced to 10 lb. by passing it through a turbine. When the generator produces an average of 350 kw. there is sufficient exhaust to heat ten dye kettles of 1,000 gal. capacity each, and only about one-seventh of the original heat is given up.

The standpoint of the dyer differs from that of the engineer; he wants to know if the effect in the kettle is the same as with direct steam and consequently whether the dyestuffs and chemicals act the same. Many instances are known of trouble being encountered in dye houses when the attempt has been made to change from high pressure to exhaust steam, and in some cases the old system has been reverted to. This is not surprising when one considers the factors affecting the control of steam.

High pressure steam direct from the boilers is usually maintained at a fairly constant pressure; a system averaging 150 pounds to the square inch seldom goes below 145 or over 155. This means that the rate of conduction of heat through a set outlet increases only about one-twentieth from minimum to maximum. Therefore, reasonably good temperature regulation in the dye bath is obtained by very simple means, and the ordinary value with hand regulation is often satisfactory.

The problem presented in the use of turbine exhaust

for open kettle work in the dye house is entirely one of control, because there is no contamination of the steam with oil, as in the case of reciprocating engine exhaust. There is really no difference between a high pressure system and a low pressure system at the point where the steam strikes the liquor in the dye kettle. The transmission of heat at this point is virtually the same whether the source is high or low pressure steam and, in fact, with the common arrangement of high pressure piping, the pressure on the kettle side of the regulator valve is actually low.

Depending upon the arrangement and regulation of the system, the pressure in the exhaust steam line may or may not vary. If it rises from 5 to 15 pounds, gauge

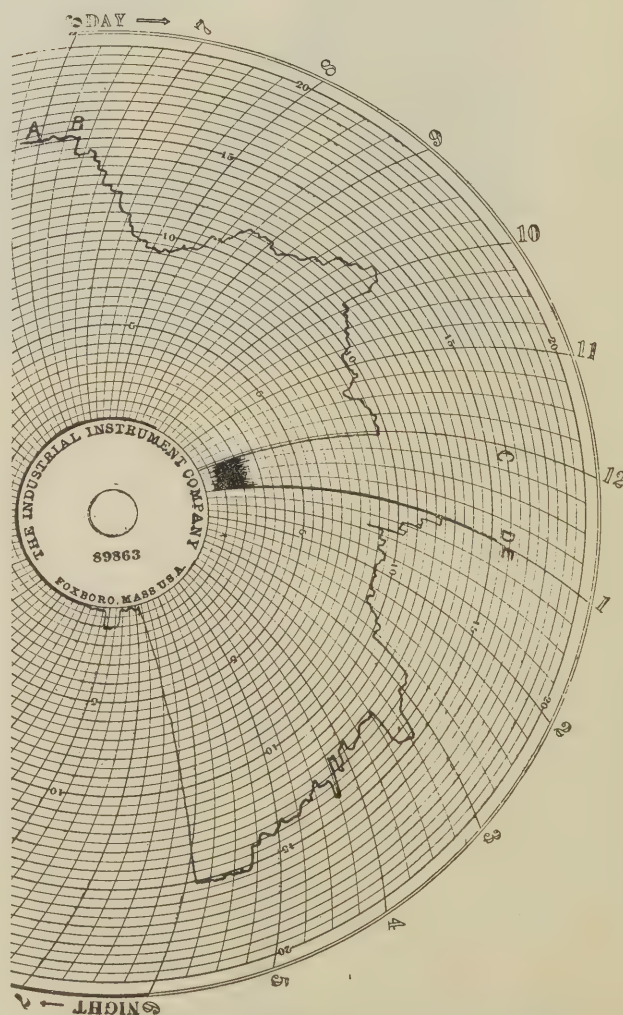


Figure 1

*Dyeing in machines where the pressure is above that of the atmosphere can be accomplished by the aid of exhaust steam heat only when the pressure of the exhaust is unusually high.

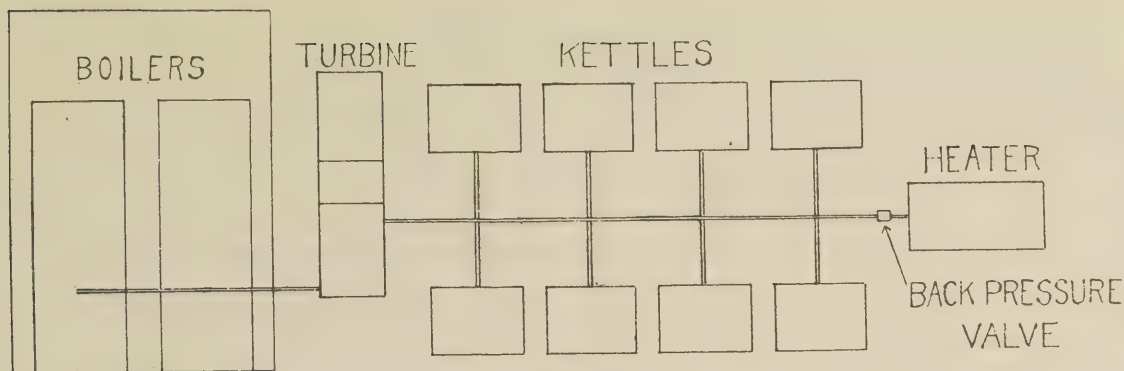


Figure 2

pressure, the rate of conduction of heat through a set outlet increases about one-half, as compared to one-twentieth for the high pressure system previously mentioned. From this, one can see that hand regulation of the temperature of the dye bath is very difficult or impossible when the pressure varies so much. This depends somewhat upon the regularity and suddenness of the rise and drop of pressure.

SYSTEM OF TURBINE EXHAUST CONTROL

Figure 1 represents a chart for a main in which the pressure varies between 0 and 15 pounds. In this system (see figure 2) the exhaust from the turbine goes directly into the dye house line, which has a back pressure valve set at 15 pounds. The outlet of this valve is piped to a water heater of capacity to take care of the entire exhaust. Section AB of the chart shows the pressure before any steam is drawn at the kettles; CD when the turbine is running without a load (on account of lunch hour in the department using the power from this unit) and there is not enough steam supply to do the work; and E shows the great pressure increase when the turbine again takes the power load.

With this arrangement there is sufficient steam of varying pressure for all the kettles when the turbine is operated with a full load, but at lunch period there is practically none.

Such a system is dangerous in a dye house, even though a drop in pressure is not necessarily harmful (although in union dyeing it might be) it delays the process and makes more labor. An abrupt rise of pressure, however, is decidedly dangerous, as there is a correspondingly sharp increase in the rate of flow of heat into the kettle, and thus a great acceleration of chemical action might take place.

Figure 3 is a chart with sections corresponding to those of figure 1 for a system (see figure 4) which has next to the turbine a branch line with a back-pressure valve operated by a damper regulator set at 10 pounds. This valve is connected with a large water heater. Next to this branch line is a check valve, and beyond is a live steam supply controlled by another damper regulator set

at slightly less than 10 pounds. The branch lines for the kettles come next, and at the end of the line is a relief valve, set at 11 pounds, as a safeguard in case the regulators do not function.

Other devices could be used to produce the same effect, and any arrangement which keeps the pressure within narrow limits is entirely satisfactory for woolen and worsted dyeing in the open kettle.

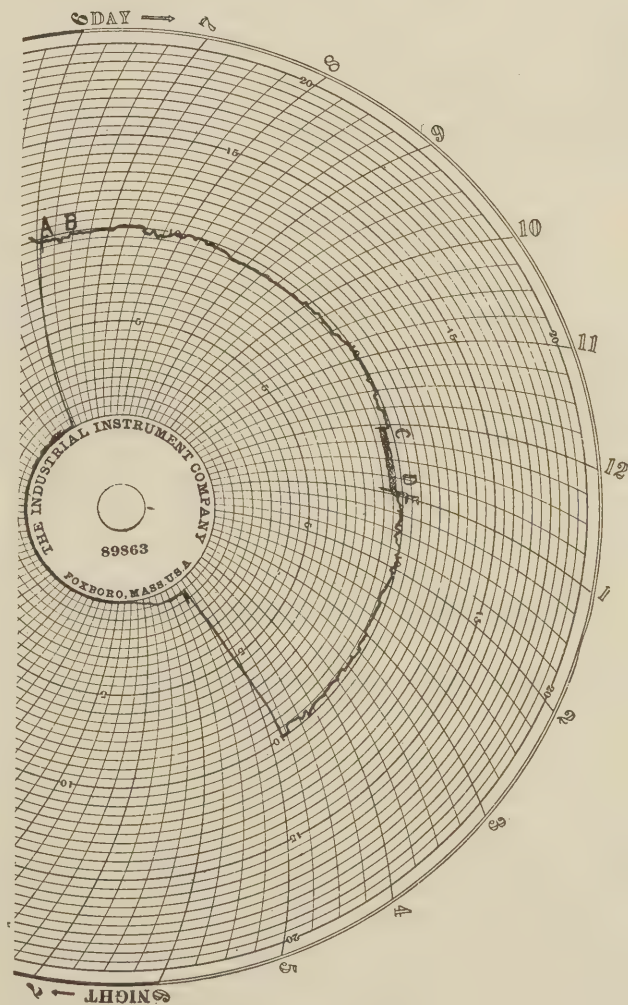


Figure 3

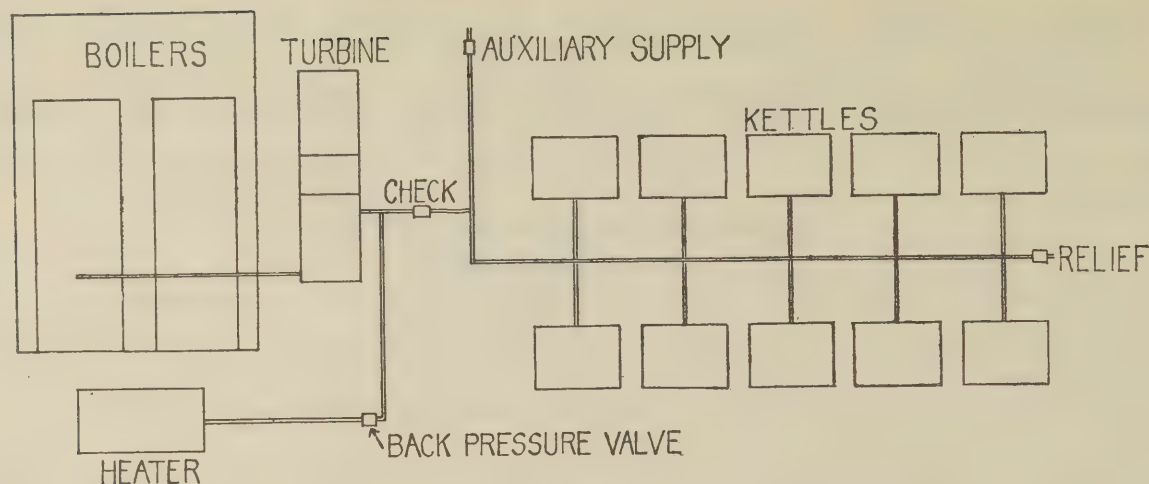


Figure 4

PIPE REQUIREMENTS

In changing from a high pressure to a low pressure system it is advisable not to alter the piping in the dye kettle if the old piping has previously given satisfaction. If it is found that the kettle cannot be heated quickly enough the holes may then be enlarged or additional ones made. Of course the main and branch pipes will all have to be larger right down to and including the regulator valve at the kettle, and the volume capacity will have to be from 3 to 8 times greater depending upon the oversize of the old pipes, and the difference between the pressures involved.

SUMMARY

It is easier to control the temperature of the dye bath when using direct steam than when using turbine exhaust, principally because the rate of flow of heat through a set outlet varies only slightly with the usual deviations from average boiler pressure, while it varies greatly with the pressure irregularity of an exhaust line. This drawback in the use of exhaust steam can be overcome by devices which maintain the pressure within narrow limits, then it is suitable for heating dye kettles.

ANALYSIS OF ANILINE OIL

A Rapid and Sufficiently Accurate Method for All Ordinary Textile Coloring Requirements

By P. F. ESTEY

Chemist, Bradford Dyers Association, Bradford, R. I.

CHEMISTS who have followed the purity of domestic aniline oils have been much gratified by the steady improvement made in this product. When the first domestic oils were placed on the market, it was difficult to detect by the odor whether the products were benzene, nitro-benzene or aniline. These impurities often ran as high as 3 or 4 per cent each, with a generous amount of

water included for good measure. A few months later, however, the oil was subjected to a redistillation which reduced the total percentage of impurities to from 1 to 3 per cent. The foreign materials consisted of a small amount of benzene and water, nitro-benzene, and traces of other high boiling compounds. So great has been the advance in the purification of the oil that at the present time only 1 per cent of impurities or thereabouts is found in the best grade.

SPECIFIC GRAVITY

The first test to be made in the examination of an aniline oil is the specific gravity. This is best carried out with a Westphal balance. The reading should be taken at 60 degrees Fahrenheit and should be 1.026-1.027. A lower specific gravity indicates the presence of water or benzene in appreciable amounts, while a reading above 1.027 points to an excess of nitro-benzene or other higher boiling oils.

DISTILLATION

By far the most important process in the analysis of aniline oil is the distillation test. This is carried out in a regular distilling flask of 600 c.c. capacity, 500 c.c. of oil being used for the test. A special thermometer graduated in 1-10 of 1 deg. C. from about 170-190 deg. C. is corked in the neck of the flask. If possible the scale should be inside the neck. Care must be taken that the mercury tube does not touch the oil. A 24-inch condenser which is connected with the tube of the distilling flask should be used. When the joints are well secured gas is applied to the bottom of the flask, and the distillation started. The traces of benzene come over first and are soon followed by a small amount of water. Water and benzene can be collected separately if desired and the percentages calculated. The temperature then rises rapidly until about 182 deg. Cent. when the oil commences to distill. Enough heat should be used to cause a steady flow of aniline. When 10 per cent of the

oil has been collected the reading of the thermometer should be taken carefully as it is quite certain that pure aniline is distilling at this point. The distillation is continued at the same rate until the thermometer has gone up exactly 0.500 deg. Cent. from the first reading. The gas burner is now removed and the remaining oil in the flask allowed to cool. It contains the nitro-benzene and other oils boiling higher than aniline with some aniline oil. It has been found from experience that at least 88 to 89 per cent of the oil should distill within the temperature limits if the aniline is satisfactory. The amount left in the flask should not be over 5 to 8 c.c.

An excellent test for the non basic impurities is conducted as follows:

Make up a dilute solution of hydrochloric acid in a glass stopper 100 c.c. graduate containing 18 c.c. of concentrated hydrochloric acid to 72 c.c. of water. Add 10 c.c. of aniline oil measured in a pipette. The aniline hydrochloride is a colorless solution. Benzene floats on the top. The higher boiling oils form a cloudy sediment. This turbidity should be slight after standing twenty-four hours.

These tests will be found to give the analyst an accurate value of aniline oil examined. They have the virtue moreover of consuming much less time than more elaborate methods which are sometimes employed.

Some Phases in the Bleaching of Cotton Knit Underwear

Requirements Demanded in the Finished Goods—Equipment Required—Boiling-Out Process—Bleaching Proper—Methods of Preparing Bleach Liquor—Washing, Treatment with Antichlor, and Bluing—Test for Traces of Chlorine—Necessity for Scientific Control

By GEORGE I. PUTNAM

Chief Textile Chemist, Mohawk Valley Cap Company, and Consulting Chemist, Utica, N. Y.

IN the bleaching of cotton knit underwear no set of fast rules can be laid down, as conditions will vary from day to day, and only the man directly in charge should know how to vary his bleaching process to meet these existing conditions.

Bleaching is a chemical process which removes the mechanical impurities, fats and waxes, and coloring matter from the fiber, leaving a pure fiber of cellulose.

At least four results should be obtained in bleaching, namely:

1. A uniform white cloth.
2. A cloth of very soft feel.
3. A cloth of life and elasticity.
4. A cloth which will give the same tensile strength as will the peeler.

It is possible to get these four results if care is taken in using the proper chemicals; in thoroughly understanding the chemical reactions which take place during the entire bleaching; in the use of the proper mechanical equipment, and by chemical control throughout.

REQUISITE MECHANICAL EQUIPMENT

As to the mechanical equipment, to-day the pressure kier is almost entirely used as a means of boiling out the underwear previous to bleaching. Any of the standard makes are satisfactory for this boil-out, and their size in any bleachery depends upon the amount of goods bleached per day in that particular plant.

After the goods have come from the kier, the most up-to-date method of treating them is the continuous

system. The number of tanks in this system may vary, but to obtain the best results there should be at least eleven. Each tank, with the exception of the lime tank, should be properly equipped with a bottom and a top roll lined with copper, an inlet pipe for water, and two outlet pipes located about 3 inches from the top of the tank, thus making it possible to have a continuous flow of water whenever needed. Each tank should have a capacity of at least 350 gallons.

The trucks into which the goods pass at the end of the several operations should be so constructed that air can pass through the cloth from all the four sides.

BOILING OUT

For the boil-out in the kier, which is the first operation in the process of bleaching, most all bleachers use the same chemicals, but no two will use exactly the same amounts. A very satisfactory formula for a kier boil-out, which will produce goods of a clean and even bottom, is 2 per cent caustic soda, 1 per cent soda ash and $\frac{1}{4}$ per cent silicate of soda. In the last two or three years there has been placed on the market a chemical compound known as oakite, which has been found to work very satisfactorily in combination with caustic soda and soda ash, or with caustic soda alone or with soda ash alone. Two satisfactory formulas of 2 per cent caustic soda and 1 per cent oakite, or 2 per cent soda ash and 2 per cent oakite, are being used; and those using oakite claim that the results are equal in every respect to the results obtained in using caustic soda, soda ash and silicate of soda, and in addi-

tion a softer-feeling piece of material is finally obtained.

The usual length of time for kier boiling under pressure is eight hours, which is the minimum length of time required to obtain the necessary results; namely, a clean bottom and the avoidance of harsh goods.

RINSING AND NEUTRALIZING

After the kier boil of eight hours, the boil-out liquor should be run off and the goods thoroughly rinsed with cold water before the kier is opened, so as to avoid any possibility of air stains which might otherwise develop on any part of the goods exposed directly to the air. The goods are then run out of the kier in rope form into two tanks containing rinse water which is continuously flowing. The object of these two rinse waters is to remove more of the boil-out liquor and at the same time to cool down the goods in temperature.

They next pass into a muriatic acid sour tank which neutralizes the last traces of alkali which might still remain in the goods. It has been found that 2 quarts of 20-degree muriatic acid will sour a truckload of goods sufficiently. These goods are now run out of this sour tank into trucks, where they remain for about one-half hour. During this time the acid will neutralize any alkali which may remain in the goods, and at the same time it has the tendency to whiten the goods. After this one-half hour of standing, the goods are passed through two more rinse-water tanks which have for their objects the removal of the muriatic acid, which leaves the goods in a perfectly neutral condition—that is, neither acid nor alkali—before they are passed through the bleach liquor proper.

PREPARING THE BLEACH LIQUOR

Two main methods are being used to-day in the preparation of bleach liquors for knit underwear; namely, the electrolytic method, which is the dissociation of salt brine by means of the electric current, and the other method is the passing of liquid chlorine into a solution of water, soda ash and caustic soda. The final chemical product in either procedure will be the same.

The goods are now ready to be run directly from the two rinse waters mentioned above through the bleach liquor proper. At this point it might be stated that the writer has found in many instances that in cotton knit underwear bleacheries the length of time the goods are allowed to remain in the bleach liquor proper varies from one minute up to two hours. Bleachers in the aforementioned bleacheries have never been able to give satisfactory reasons why the goods should remain in the bleach liquor for this greatest length of time; but it seems to be a rule-of-thumb method employed years ago. Bleaching is obtained by the oxygen, and therefore there is no

logical reason why the goods should remain in the bleach liquor longer than five minutes at the most. However, it has been proven, and is being applied practically to-day, that goods submerged for one minute in the bleach liquor give results equal to those submerged for any longer period of time.

BLEACHING PROPER

To return to the process of bleaching. About five yards of the goods are submerged in the bleach liquor at one time; this allows any portion of this length of goods to be in the liquor for about one minute. They are then pulled out through light-pressure squeeze rolls into trucks, where they remain from one to two hours for the air bleaching. No definite length of time can be set for this air bleaching, as it depends directly on the condition and clearness of the bottom of the goods just previous to their entering the bleach-liquor tank. These are known only by the man directly in charge; and where one day an hour and one-half may be the correct time for air bleaching, the next day it may take two hours, and the next day possibly an hour and three-quarters.

After the air bleaching, the goods are passed through what is called the finishing operations. The first of these consists of two rinses in the water tanks for the purpose of removing the bleach liquor which is in the goods. Next they are run directly into the antichlor tank, which is used to remove the last traces of any chlorine which may be left in the cloth. Antichlor, which is chemically known as sodium bisulphite, is usually sold in either the crystal or liquid form. Enough of this antichlor should be kept in the tank so that the water will test acid at all times. As a rule, two or three quarts to a truckload of goods is sufficient.

BLUING

The goods are next put through two more tanks of rinse water, which removes the last bit of the antichlor; after which they pass into the bluing tank, which has as its aim, as the word implies, bluing the goods in order to remove the faint yellow cast which they have, and also to make them appear snow-white. The amount of bluing used varies directly with the shade of whiteness which is desired. Not all bleacheries desire the same shade of whiteness. It varies from a cream-white to a snow-white.

As each truckload of goods comes from the bluing tank, the cloth is tested for traces of chlorine with a starch-iodide solution. This solution is made up of 1 ounce of potassium iodide and 4 ounces of laundry starch. These are separately and thoroughly dissolved in about 1 pint of hot water, and then enough water is added to make the whole up to 1 gallon. For conveniently using this solution a quantity is placed in a small bottle which is fitted up with a shaker, as

only a few drops are necessary to test the goods for traces of chlorine. An indication of chlorine is a blue coloration on the cloth. The goods are now extracted, and from this point they go to the drying machine, spreaders, folders, etc.

It will be observed from the foregoing that it is necessary to have an ample supply of water in the process. This water should be soft and as free as possible from calcium, magnesium and iron, and for its clarification it should at least be passed through a mechanical sand filter.

SCIENTIFIC CONTROL OF BLEACHING

Another important fact which few bleacheries today make use of is the scientific control of bleaching. Many are running bleacheries on the rule-of-thumb method, not having anyone in charge who has knowledge of the chemistry or chemicals used, and they wonder why they have trouble in their bleachhouses.

The writer has found in many instances that the knowledge which the majority of bleachers have of chemicals is very small. For specific examples: one man was positive that sodium carbonate and soda ash were two entirely different chemicals, and that neither of these was an alkali; another, that a sour was not an acid, but simply a sour; and a third, that brown spots on goods, which were found to be iron, were not iron but just brown spots.

The textile industry has been the last of all the industries to be placed on a scientific basis, although chemical reactions are taking place every day and chemical products are being used every day. Let it be suggested that if more cotton knit underwear bleacheries would make use of industrial laboratories, or employed chemists who understood the reactions of the chemicals used, and who would be able to solve their problems, the money paid to laboratories as retainer fees or as salaries to chemists would be saved in a very short time.

Color Matching in Daylight and Artificial Light

Causes of Variation Between Natural and Artificial Light—Value of Properly Filtered Artificial Light in Color Matching—Necessity of Matching Compound Shades Under Both Standard Daylight or Filtered Artificial Light and Ordinary Artificial Light

By LEVERETT N. PUTNAM

Overseer of Dyeing, Men's Wear Department, Arlington Mills, Lawrence, Mass.

TO every dyehouse there come, at times, shades which give considerable trouble to the dyer before a suitable match can be obtained. To this class belong pearls, taupes, smoke, plums and numerous tertiary shades. It will be found that nearly all colors, especially colors of this type, are very susceptible to changes of light, and even in daylight their appearance will be greatly altered by the different angles of light in which they are observed. They are also quite likely to have a different appearance even in light from the same source when compared on a cloudy day against a fair day, or even at two different times throughout the same day. At all times the north light—that is, the diffused light—is the best for matching colors, but even that cannot be relied upon to be twice alike. The writer has found by practical experience that a good incandescent shading lamp with the proper blue filtering glass, through which the light passes, is the most suitable light for practical dyehouse purposes, and believes that the time will come when no dyehouse will be without one, as the expense is not large and the results will more than compensate for the price. By the use of a lamp the dyer has at all times a standard light to work by,

which is more than he can get with the best facilities of a good daylight.

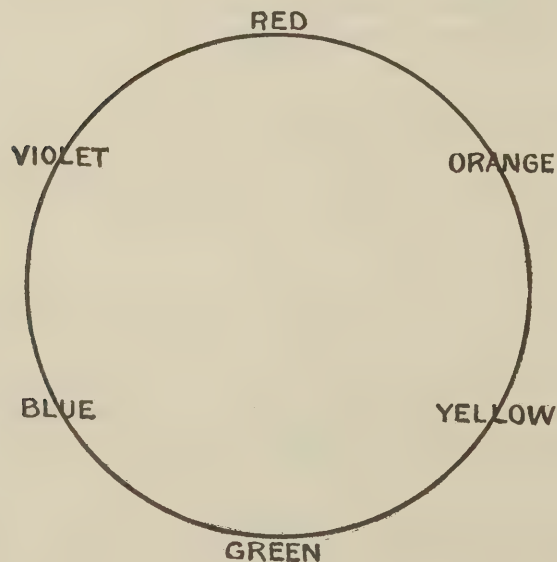
VARIATIONS IN DAYLIGHT

This variation in daylight is due (1) to absorption of portions of white light by the atmosphere, because sunlight passing through the air loses some of its violet rays, thus giving the sun its yellowish to orange appearance, and (2) to reflection of those violet rays from the "blue sky." Colors matched in direct sunlight are not subjected to pure white light, but rather to a yellowish-orange light, due to the absorption by the atmosphere of part of the blue and violet rays, which will tend to make the shade examined look different from what it would be in pure daylight. If examined in a light coming from directly opposite the sun, we have white light plus reflection from the blue sky, thus throwing us out again. The only way we can get the best daylight is to take a diffused light made by combining the yellow direct light of the sun with the blue reflected light which comes in an opposite direction from the sun; that is, north light, which

theoretically would give us back normal white light. However, clouds, reflections from outside and the shortness of the day all go to throw out the virtue of north light, and thus leave the dyer with a pretty poor apology for perfect light by which to do accurate matching.

CHARACTERISTICS OF ORDINARY ARTIFICIAL LIGHT

Ordinary artificial light is comparable to direct sunlight, as in nearly every case of artificial light there is a predominance of yellow and orange rays. When dyeings are subjected to lights of this kind we get quite a different appearance in most cases from that produced in white light. The reason for this is due to the abnormal red and yellow color rays. This variation is in direct relation to the spectrum shown by the color examined. Every dyestuff has a definite spectrum made up in nearly all cases with all colors of the spectrum. The color of the predominating rays determines the appearance of the dyestuff to the eye. What happens when we view a color in artificial light or in direct sunlight is the absorption of the yellowish-orange rays by the blue and violet color of the dyestuff, thus giving us density and allowing the rays of light not neutralized to be reflected, which reflection we see as a color.



Every dyestuff has its own characteristics with regard to artificial light in direct relation to its individual spectrum analysis, as has been said. As a summary of the general effect, however, if we consider the spectrum as a circle shown as in the accompanying figure and the red used to be Buffalo Fast Crimson R, the colors running clockwise toward the green all have a tendency to go greener under artificial light. On the other hand, those colors running coun-

ter-clockwise, or to the left of red, will appear redder and flatter, losing some of this bluish tone.

This general characteristic holds on both sides of the spectrum until you get to the component of red, which would be green. In reality the change comes where the colors tend to stay neutral in both lights, as is the case of such a color as Alizarine Sapphire, this color having the slightest tendency to go greener and duller.

It can be seen, then, if one makes a brown shade from the colors on the yellow side of the spectrum, and then subjects it to artificial light, it will go greener. This will be found true in practice. It will also be true that if the yellow be taken from the right-hand side, which in itself grows thinner and greener under artificial light, and be combined with such colors as Azo Fuchsine 6B, which loses blue and goes redder, and Alizarine Blue S.K.Y. or Violet, which also goes redder, the resulting brown will have a marked tendency to go red under artificial light.

NECESSITY OF CHECKING SHADES UNDER BOTH DAYLIGHT AND ARTIFICIAL LIGHT

If we consider the different degrees of daylight as a similar change on the effect of color matching which we get from artificial light, then it can be seen that if we match the same shade under two constant lights, pure daylight from the sky or a suitable matching lamp and an ordinary artificial light, we will be checking up one match with another. If the shade matches at both these points it surely will at any variation of light between, thus assuring a good match whenever or wherever shaded.

Matching colors in this manner is not hard to do, but does require care and a little personal knowledge of the colors which are being used to produce a definite shade with regard to their changeability in artificial light. Once this is accomplished, it allows the dyer to deliver considerably better matches, for it eliminates one thing which isn't given the consideration that it should be—that is, poor daylight—and allows all one's energies to be put into the actual matching of the shade to be produced. With a standard light like the electric matching lamps, a common electric light, and enough daylight to view a shade to get its overtone, as this is hard to get under artificial light, the dyer is fitted up to give very satisfactory work. Both for his own good and the good of his employer, he should never allow a shade to leave him without it being matched both in good daylight and by artificial light; for then, and only then, does he have control over what he is doing. In some branches of dyeing, such as yarn dyeing, printing and dyeing trimmings, where color effects have to be dealt with, this is doubly essential.

Review of Recent Literature

Dyers' Materials; by Paul Heermann; translated from the German by Arthur C. Wright, M. A.; 156 pages, 4½x7½; Scott, Greenwood & Son, London.

This is a handy dictionary of materials used by dyers. A brief description of each material is given, together with its chemical symbol, chief chemical characteristics, molecular weight, solubility, etc. It is a volume which should be valuable to any dyestuff chemist, as its contents are arranged for ready reference and its small size makes it most convenient.

Degreasing Wool and Textiles with Volatile Solvents; H. Hey, in the *Journal of the Society of Dyers and Colourists*; 36, 11-18 (1920).

Inventions tending to improve methods of cleansing textiles during the past sixty years have been many. The most generally suggested solvents have been petrol, benzene, toluene, amyl alcohol and solvent naphtha as well as in more recent years the non-inflammable chlorhydrocarbons, carbon tetrachloride and tri-chlor-ethylene.

Except for its inflammability, petrol is the most advantageous of these solvents. This defect may, however, be overcome with a properly constructed plant. Chlorhydrocarbons, although non-inflammable, are likely to develop acidity in contact with heat and moisture.

Because of the high cost of all solvents, the most rigid economy must be exercised in the methods of using and reclaiming. Thus the necessity of a closed system for all operations.

Most of the disadvantages of solvent washing, such as risk of fire following an explosion, removal of grease but not dirt, and lack of proper machinery for a continuous process have been eliminated to a great extent. The high cost of installation, however, remains to be overcome.

Solvent washing has many advantages. The reagents used may be recovered as well as the oil and grease removed from the wool. Wool that is not very dirty may need no further treatment except a washing with warm water. Solvent washing does not injure the fiber, but removes the grease. The non-soluble bodies are then removed by mechanical treatment. The dissolved grease supplies a condition which makes this removal easy as, when dissolved, it becomes a lubricant in the solvent.

Wool degreased with a solvent does not dye so quickly with acid dyes as when treated with an alkali. The former process, however, avoids the weakening of the fiber by the alkali.

Color in Woven Designs; Robert Beaumont, M. Sc., M. I., M. E.; 367 pages; 5½x8¾; profusely illustrated; Isaac Pitman & Sons, New York; \$7.50.

This is a second and greatly enlarged edition of a volume already widely and favorably known. The num-

ber of new illustrations in this edition is particularly important. In general the work is an invaluable aid to the designer of colored textile fabrics. The following order is observed in the treatment of subjects:

Theories of Color; Attributes of Colors; Contrast and Harmony; Color Standardization; Mixtures; Elements of Textile Coloring-Stripes; Check Patterns; Simple Colorings; Compound Colorings; Fancy Shades Applied to Special Designs; Coloring of Combination Designs; Spotted Effects; Coloring of Double Weaves and Reversibles; Figured Textile Colored in the Warp; Weft-Colored Figured Fabrics-Curl Textures.

Bacteria and Molds: Their Biological Nature and Their Influence on Vegetable Fibers. J. Frederic Corri-gan, in the *Journal of the Society of Dyers and Colourists*, 36, 198-201 (1920).

The author discusses briefly the relationship between bacteria and molds in the vegetable kingdom, with particular reference to their application in the textile industry: First, the decomposition of cellulose by bacterial agencies, which may be accomplished by the action of an enzyme cytase or by bacteria either aerobically or anaerobically. Second, organisms bringing about the retting of flax, viz.: the gummy substances which hold the fibers together are attacked by these organisms. This rets the fibers but does not have any effect on the cellulose of the fibers. Various organisms were found impregnating flax taken from crates during the retting process; *B. Flourescens putidus* were the most active. Third, bacterial growth developing on cotton and other fabrics. This is distinguished by small colored spots, each spot being an actual colony of bacteria. These colonies often grow to such proportions as to cover the entire cloth. They cause a decomposing action upon cellulose and starch matters which results in the tendering of the cloth. Fourth, the destruction of bacterial growths on finished goods may be accomplished by heat, light, and antiseptic substances, but the most dependable of these are the antiseptic substances, such as CuSO_4 , KNO_3 , ZnSO_4 , ZnCl_2 , boric acid, formaldehyde and various phenols.

Chemistry for Textile Students; Barker North, assisted by Norman Bland; 355 pages, 5¼x8¾; University Press, Cambridge, England; \$7.50.

The authors explain that this volume is a result of their conviction that a great knowledge of chemistry is essential to those engaged in the manufacture of textiles. They point out that a smaller percentage of thoroughly-trained technicians is employed in the British textile industry than in any of the other ten leading industries. The work is of a thoroughly academic nature and is divided into 38 chapters under the following general divisions: Introductory, Systematic Study of the Non-Metals, Chemistry of the Hydrocarbons and Their Derivatives, Technical Textile Chemistry. It is a book which should be of value to any student of textile chemistry.

AMERICAN DYE STUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 7, NO. 15
OCT. 11, 1920

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

In an article entitled "Cotton Dyeing—Past and Present" Professor Louis A. Olney outlines the development of the science of dyeing from the use of natural Indigo in Pharaoh's time through the application of modern vat colors.

"Water and Its Application in the Textile Industry." Under this head Walter E. Hadley presents the first of a series of articles devoted to the characteristics, purification and uses of water in textile manufacturing processes.

All papers read before the Dye Division of the American Chemical Society at the recent meeting in Chicago are abstracted and, in some instances, quoted at considerable length.

Walter M. Scott, Ph.D., head chemist of Cheney Bros., describes methods which he has developed for making and recording the results of dyestuff tests.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 7, No. 15

NEW YORK, OCTOBER 11, 1920

Section 2

Cotton Dyeing—Past and Present

Historical Outline of the Science of Dyeing—Development of Union Colors—Classification of Coal-Tar Dyes—Sulfur Colors—Turkey Red and Para Red—Vat Dyes—Dyeing Machinery

By LOUIS A. OLNEY

THE dyeing of textile material is an ancient industry. We have positive evidence that a process of indigo dyeing was in use during Pharaoh's time, and there is every reason to believe from various ancient writings, that other coloring processes were in use at still earlier dates. The early knowledge in regard to dyeing was almost entirely empirical, i. e., attained through promiscuous experimentation in various directions without any systematically or scientifically laid plan. About the earliest constructive or scientific literature in regard to dyeing appeared during the latter part of the eighteenth century, and was written by three Frenchmen, Hillot, Macquer and D'Apilgny, and was translated into English in 1789. While from the modern point of view this book contains but little of value, it furnishes rather entertaining and not wholly unprofitable reading. The first English writer of note upon the subject was Edward Bancroft, M. D. His first writings appeared as early as 1769 but it was not until 1814 that he published his classical work in two volumes entitled "Experimental Researches Concerning the Philosophy of Permanent Colors." This may be looked upon as about the first scientific contribution to literature on the art of dyeing. Bancroft's classification of dyes into "Adjective and Subjective Dyes" is really used to-day, but under the headings of "Mordant and Direct Dyes."

FUNDAMENTAL CONSIDERATIONS INVOLVED

The dyer in all ages has been confronted with one basic consideration, namely, the entire difference between the action of vegetable and animal fibers toward chemicals and dyes, and in the light of modern dyes and recent developments this difference has become even more marked. A process that will dye wool and give excellent colors may not dye cotton at all and other processes excellently suited for dyeing cotton if applied to wool would result

in the complete destruction of that fiber. For these reasons cotton and wool dyeing naturally become two quite different problems and this is the reason why we so frequently hear cotton and wool dyers spoken of as quite different individuals.

Modern developments in the textile industry have lead more and more to the production of union fabrics with two or more fibers, usually cotton and wool, or cotton and silk, combined together. This combination of animal and vegetable fibers in the same piece of goods immediately complicates matters as far as dyeing is concerned. Many of the most satisfactory wool dyes as well as a large proportion of the desirable cotton dyes are immediately eliminated for the dyeing of this union material. Dyes must be selected for this purpose which naturally, or through skillful manipulation, can be deposited upon and within both animal and vegetable fibers so as to give the same depth of shade and approximately the same degree of permanence with each. This often becomes a difficult matter and the dyer of union material is confronted with many problems which are seldom if ever met by straight cotton, wool or silk dyers. In the early days of manufacturing a mill was almost without exception a cotton mill, a woolen or a silk mill, but to-day there are very few of the larger textile corporations that do not use at least two of these fibers and many all three. In addition to these, the artificial silks (luster celluloses) of different types have been introduced. It is therefore evident that the modern dyer cannot confine himself entirely to either cotton or wool, but must have a working knowledge of both fibers and their coloring properties.

CLASSIFICATION OF DYES

The coal-tar dyes may be classified in several different ways but for the use of the practical dyer there is but one satisfactory method, namely, that which divides them

according to their action upon the different fibers; in other words, according to their methods of application. This classification recognizes ten groups as indicated in the following table. The fibers to which these dyes are applicable are also indicated in each case, and their most important uses in *italic type*. A blank line indicates that dyes are either not used at all or their application so limited as to be of little consequence.

Class of Dye	Fibers Upon Which They Are Applicable		
1. Basic dyes	<i>Cotton</i>	<i>Wool</i>	<i>Silk</i>
2. Eosins and related dyes.....	<i>Cotton</i>	<i>Wool</i>	<i>Silk</i>
3. Acid dyes	<i>Wool</i>	<i>Silk</i>	
4. Direct cotton colors	<i>Cotton</i>	<i>Wool</i>	<i>Silk</i>
5. Sulfur dyes	<i>Cotton</i>		
6. Mordant dyes	<i>Cotton</i>	<i>Wool</i>	<i>Silk</i>
7. Mordant acid dyes (after chrome colors)	<i>Wool</i>	<i>Silk</i>	
8. Insoluble azo dyes	<i>Cotton</i>		
9. Reduction vat dyes	<i>Cotton</i>	<i>Wool</i>	<i>Silk</i>
10. Aniline black	<i>Cotton</i>		

GENERAL SURVEY OF COTTON DYEING

Previous to about 1860 cotton dyers were limited in their selection of colors to various vegetable products and a few mineral pigments which were commonly produced from various combinations of chemicals during the process of application. The most important vegetable dyes were logwood for black; indigo for blue; madder for fast shades of red and the red dyewoods such as barwood, Lima wood, and saunders wood for the cheaper and less permanent reds; fustic, quercitron, Persian berries and tumeric for yellow; and cutch for brown. There was no straight green dye of importance, but for that purpose indigo combined with some yellow dye was commonly used. Olives, tans, browns, drabs, slates, etc., were produced by various combinations of these dye woods. The above were all mordant dyes except indigo, a reduction vat dye, and tumeric, one of the very few vegetable dyes which appeared to have direct affinity for cotton. The mineral dyes applicable to cotton were Prussian blue, iron buff, chrome yellow and manganese brown.

The variety of shades that could be produced with all of the foregoing dyes was limited and the brilliancy of the colorings was not by any means equal to the possibilities of to-day. This fact is conspicuously emphasized when one has an opportunity to compare the sample books of a large print works of to-day with those of the same concern fifty or more years ago.

In 1856 Perkin discovered the first coal-tar color, which became commercially known as "Mauve." It was a basic dye of only ordinary value and has long since been replaced by other more desirable dyes, but from a historical point of view it is of more interest than any other. By 1869 the coal tar color industry had become an assured fact and from that time on its development

was phenomenal and different classes of dyes were introduced with great rapidity. Great difficulty was at first experienced in producing dyestuffs that would color cotton directly. For nearly twenty years basic, acid phthalic anhydride, mordant dyes and aniline blacks were the only groups represented. The basic colors, and mordant dyes had to be applied in conjunction with mordants which at once introduced a complication. The acid dyes possessed no affinity whatever for cotton, and aniline black was applied by a rather complicated and extremely sensitive process. The wool dyer during the same period had at his disposal many coal-tar dyes that would color wool directly. The acid dyes, basic and phthalic anhydride colors all dyed wool without the use of a mordant. As time went on the demands of the cotton dyer for direct dyeing colors became more urgent and emphatic, but it was not until 1884 that the first direct cotton color, Congo Red, was put upon the market. From this time on developments were much in the cotton dyers' favor. Congo Red was rapidly followed by numerous other direct cotton colors possessing great variations in color-producing properties.

The direct cotton colors as a group had decided limitations as far as usefulness was concerned. Their fugitiveness to washing and their property of bleeding eliminated them almost entirely for calico printing and for the dyeing of yarn which is to be used for ginghams and shirtings where white or light colors were to be used in conjunction with shades produced with direct cotton colors.

SULFUR COLORS

The cotton dyer however did not have long to wait for improvements in this respect, for the sulfur colors introduced during the 1890's possess excellent fastness to washing in most cases, very good to light and were even sufficiently fast to mineral acids to permit of union cloth composed of white wool filling, and cotton warp, dyed with a sulfur dye to be dyed with wool color in a decidedly acid bath. These sulfur colors have proved of great value to the cotton manufacturer, on account of fastness and comparative simplicity of application. They may be applied in the dyeing of gingham, shirting, hosiery and for numerous other purposes. They cannot be used successfully in calico printing on account of their action upon the copper rolls. In most instances the sulfur colors are very sensitive to chlorine, but in most cases this is no serious drawback. Among the sulfur colors blacks, blues and browns predominate, in fact they are characterized by the general somberness of the shades they produce. There are some sulfur yellows and greens, and one sulfur maroon and a dull reddish violet but as yet no real sulfur red has been discovered. The American color manufacturers have made excellent headway in the manufacture of sulfur colors both as to quality and yield, and we frequently hear the report that some of the domestic sulfur colors are superior to any of the pre-war products.

TURKEY RED AND PARA RED

For hundreds of years the favorite red upon cotton was Turkey Red which was produced with Madder in conjunction with an aluminum mordant. The process of application was complicated, involved ten or a dozen different steps and then required several weeks for completion, but the final result was such an excellent red as far as attractive shade, and permanence was concerned, as to repay the dyer for his labors. It would resist sunlight for weeks, repeated washings and even a mild bleaching process. With the introduction of sulphonated Castor Oil (Turkey Red Oil) the time required was shortened materially, but even then it was impossible to produce a satisfactory red in much less than three or four days. In 1868 Alizarine, the active coloring principle of madder root, was made directly from anthracene, a coal-tar product, and while this facilitated matters a little it did not materially affect the length of time consumed in the application. About 1890 a decided innovation in dyeing and calico printing was introduced in the form of the so-called insoluble azo dyes. Of these the so-called para red and the alphanaphthylamine claret were by far the most important. The former (para red) gives dyeings equal in brilliancy to Turkey Red and of sufficient fastness in most every respect to answer the requirements of Turkey Red. The process of application consists simply in preparing the cotton cloth with a sodium beta-naphtholate solution, drying and then passing through a solution of diazotized para-nitraniline. The actual production of the color only requires two or three minutes but if all of the preparing and drying processes were considered this would be extended to half an hour or more. It can readily be understood why Turkey Red dyed on printed cloth soon lost its supreme position as a cotton red, and why para red has almost entirely replaced it for all of the ordinary requirements. The claret red is produced in a similar way to para red, and for deeper and bluer reds is almost as extensively used as the former.

THE VAT DYES

The latest development in cotton dyeing and perhaps the one presenting the greater possibilities was the introduction of the Reduction Vat Colors commonly spoken of as the Vat Dyes. In one sense they were not new, for indigo is a typical vat dye, but it had remained the sole representative of the class until 1901 when Indanthrene was introduced. Indanthrene produces shades of blue which are brighter and faster than indigo, but is of entirely different chemical structure. The discovery of indanthrene and flavanthrene, a valuable yellow vat dye, awakened great interest as to the possibilities of the group and the period of extensive research which followed was well rewarded. One after another vat dyes were discovered until today it is possible to produce not only a great variety

of vat blues, but reds, scarlets, violets, yellows and through combination almost any color. As a group the vat dyes possess very excellent fastness to washing, and in some instances will go through a complete bleaching process without being materially altered. The earlier vat dyes like indanthrene also possessed a remarkable fastness to light; indanthrene being much superior to indigo in this respect. This fact led color chemists and dye users to hope that the whole class of vat dyes would maintain an equal degree of light fastness but in this respect they were disappointed, for some of them possess rather inferior fastness to light. Their fastness to washing and soaping is well maintained throughout the group and thus render them of great value in the manufacture of gingham and shirtings and calico prints, and on certain cases their resistance to chlorine makes them useful as towel borderings which have to be subsequently bleached.

The principle involved in the application of the vat dyes is simple. In their commercial form they are all insoluble in water, but when strongly reduced with a hydrosulphite they are temporarily modified in chemical composition and readily go into solution in an alkaline bath. From such a bath they are readily absorbed by cotton material, and as soon as such saturated material is exposed to the air or some other oxidized influence, the reduced dye is converted back to its original insoluble form in which state it is permanently retained by the fiber. In practice, however, the operation is not so simple as would be anticipated. For some time after their introduction they caused much trouble owing to their many peculiarities but experience has gradually overcome most of these difficulties, so that to-day excellent results may be depended upon in most instances.

No vat dyes were made in this country previous to the war, and cotton manufacturers were quite upset when the stock of these dyes was exhausted. Vat dyes are among the most difficult dyes to manufacture, and it is in respect to this class perhaps more than any other that the achievement of the American dyestuff manufacturers is to be commended. As a result of their industry, American made indigo has been on the market nearly two years, and several manufacturers are now selling or are about to introduce a considerable number of vat dyes. In cotton dyeing two quite different types of machines are used: First, those in which the material being dyed circulates through the dye liquor, and second, those in which the dye liquor is forced, usually by means of a pump, through the material being dyed, which remains perfectly stationary. The first type is the older of the two and includes most of the machines formerly used for all kinds of cotton dyeing. Recent years, however, have seen a decided trend toward the second type, for they are more economical in most every respect, and were it not for the fact that they are unsuited for certain classes of dyes, and likely to produce uneven dyeings with others, their introduction would have been more

rapid. This second type of machine has even been extended to the dyeing of warps on the beam, and the next few years will see many advances along this line, particularly as concerns warps, cops and spools of yarn and slubbing.

The American cotton dyeing and printing industry is

rapidly becoming self sustaining as to dyes, chemicals and all types of machinery and appliances. With proper protective support from the Government there need be no fear in the future for this branch of the textile industry even though temporarily isolated from the rest of the world.

Water and Its Application in the Textile Industry

Various Classifications of Water—Common Impurities—Hardness and Methods of Softening—Organic Impurities—Ordinary Methods of Filtration

By WALTER E. HADLEY

ONE of the most important factors for the management of a textile mill to consider is that proper steps are taken to insure at all times an adequate supply of pure water for use in the power plant as well as for the various operations of bleaching, dyeing and finishing.

The object of this paper will be to outline, in a more or less practical manner, the different types of waters and the characteristics which they exhibit under the varying conditions met with in the textile industry.

While, in a broad sense, waters are considered under two general headings, i. e., sanitary and technical, it is the present purpose to consider only those which come under the latter classification.

The sources from which water for technical purposes may be derived can be classified as follows:

- Distilled Water.
- Rain Water.
- Surface Water.
- Sub-Soil Water.
- Deep-Well Water.
- Sea Water.
- Mineral Water.

Distilled Water.—When the temperature of any water, containing mineral impurities, is raised to the boiling point and the steam arising from the same is passed through a properly constructed condensing apparatus, the resultant water is free from all dirt and mineral matter, but may still contain gases which may have been present in the original water. Such a water is known as distilled water and in such a state would be the ideal water for technical purposes. Unfortunately, the high cost attendant upon the preparation of such a product precludes its use except in special cases. Distilled water free from dissolved gases can be prepared by using special precautions but is of interest only for scientific work.

Condensed steam, under certain conditions, may be advantageously employed in technical work, such a water being free from mineral matters contained in the original water, but unfortunately waters obtained

from such a source are extremely liable to contain volatile oils which have entered the water at steam traps, etc. Furthermore water prepared from condensed steam is often contaminated with particles of iron rust, which have become dislodged from the steam pipes, and for these reasons this source of supply does not yield an entirely satisfactory product.

Rain Water.—The purity of rain water depends upon the locality in which the rain occurs. For instance, the air, above large cities, containing many manufacturing plants, gas works, chemical factories, etc., is necessarily contaminated with many gases and foreign particles, many of which are soluble in water. The first rain which falls will therefore begin to dissolve the soluble gases, and at the same time mechanically bring down the insoluble impurities contained in the air. The water precipitated during the early part of a rain storm will, therefore, be very impure. That which falls after the air has been thoroughly cleansed, by the earlier rain, is a very pure form of water and could be used with extremely satisfactory results for many textile requirements. Care would naturally have to be taken regarding the collection and storage of such water. In the opinion of the writer, such a source of water would be entirely inadequate except in very small textile plants.

Surface Water.—This type includes the water from brooks, rivers, ponds, lakes, etc., as well as sea water. Sea water being an eventual culmination of all other types of water, and being so filled with inorganic impurities, will be considered by itself. Rain water after falling upon the earth immediately begins to absorb the different soluble substances with which it comes in contact and is no longer the pure product which it was while still in the air. For instance, a water in contact with insoluble earthy matter, mechanically takes unto itself, and holds in suspension insoluble matters contained upon and within the soil and rocks with which it may have come in contact. Thus, a perfectly pure rain water, falling in the open country far from the contaminating influences of the smoke, acid fumes, and other forms of impurities which would exist in the air above cities, may upon reaching the earth immediately begin to dissolve one or more mineral

substances which will render it wholly unsuited for textile requirements. Thus, a water falling upon a section containing calcium, aluminum, magnesium, or iron may quickly change its identity. Again, surface water which is perfectly suited for textile uses may, in its journey to the sea, become polluted by passing through other forms of impure waters, or by having sewage, containing all manner of manufacturing wastes, deposited within it. In addition to the inorganic impurities, a water may readily become polluted with many types of organic impurities.

In addition to rain, which provides a very fine contribution for surface waters, we must consider the sub-soil waters which may or may not be pure, the purity depending upon the character of the soil with which the water has come in contact. For instance, a pond, river, or lake which is fed from a very pure water shed may also be fed from springs which furnish a type of mineral water which would wholly unfit it for use in a textile establishment.

Sub-Soil Water.—This is the water which is found immediately below the surface, but which has not penetrated the upper stratum and has thus been kept away from the deep well waters. It includes springs, shallow wells, etc. The quality of the waters obtained from this source vary greatly depending upon the locality.

Deep-Well Water.—The water from deep wells varies greatly in composition depending upon the nature of the subterranean soil with which the water has been in contact, a soil containing insoluble substances yielding extremely pure water while a soil containing easily soluble substances would produce a very impure water. The deep-well waters are obtained by sinking a shaft through the impervious strata until water is obtained which may have its original source in hills many miles away from the well, the water having been seeking its level, filling all the underground caverns, and only waiting for the sinking of a well to issue forth, oftentimes under sufficient pressure as to preclude the necessity of pumping.

Sea Water.—Sea water is not of interest for industrial purposes and cannot be used unless thoroughly distilled. Ordinarily sea water contains about three to four per cent of common salt, sodium chloride, NaCl, as well as smaller quantities of magnesium and calcium sulphates.

Mineral Waters.—As a rule, mineral waters are totally unsuited for industrial purposes unless they can be purified, in which case the cost of purification must not be so high as to render their use prohibitive.

IMPURITIES EXISTING IN WATER

The principle impurities existing in water, which must be largely overcome, if satisfactory results are to be obtained in textile work, may be outlined as follows:

Suspended Matter.—This consists of dirt particles,

either organic or inorganic, and such substances as may be removed by filtration.

Organic Matter.—If a large amount of organic matter is present in water, it indicates pollution due to the introduction of sewage into the water. This organic matter is shown by the high amount of ammonia contained in the water. Any water containing a high amount of organic matter should not be used for textile purposes unless carefully examined as to its action in the specific work to be undertaken.

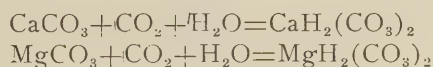
Iron.—Iron often occurs in waters polluted with sewage, but it also occurs in other types of waters. It generally occurs as the bicarbonate of iron. This substance undergoes decomposition readily, often when in contact with air and sunlight. Iron rust and particles of iron due to local causes, are easily removed, and are not classified as impurities existing in the water proper.

It is difficult to draw any hard and fast line as to the amount of iron permissible in a water, this being dependent upon the treatment which the material being processed is to receive. If bleaching is being carried out no water containing iron should be used following the last acid treatment.

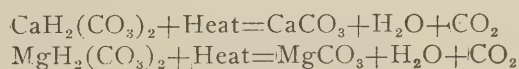
Sodium Chloride.—Water containing an appreciable amount of sodium chloride is unsuited for textile work. The only practical way to get rid of this impurity being by distillation, the cost of such a process is prohibitive.

HARDNESS OF WATER

The Carbonates and Sulphates of Calcium and Magnesium.—Calcium and magnesium carbonates are practically insoluble in ordinary water but are quite readily soluble in a water containing an excess of carbon-dioxide gas. The normal carbonate of magnesium is expressed by the chemical formula $MgCO_3$ and likewise the normal carbonate of calcium is shown by the formula $CaCO_3$. If either of these two insoluble substances come in contact with a water containing carbon dioxide in solution the insoluble calcium and magnesium carbonates are changed into their corresponding bicarbonates which are readily soluble. This change is shown by the following equation:



Carbonates in water owe their presence to the carbon-dioxide contained therein. If the water is heated, the bicarbonates are decomposed, carbon-dioxide being liberated and driven off, the normal carbonates of calcium or magnesium precipitating, and the water becoming soft.



Such a water is known as a Temporary Hard Water,

A water, containing metallic elements which cannot be removed by boiling, is known as a Permanent Hard Water. Thus the presence of iron, aluminum, calcium or magnesium chloride or sulphates, would impart a permanent hardness to water.

The measure of hardness is expressed as parts of calcium carbonate in a definite volume of water, regardless of whether the hardness owes its origin to calcium or magnesium salts.

There are two scales of hardness which find general application, i. e.:

Clark's Scale—This system is based upon 1 part of CaCO_3 per 70,000 parts of water. Corresponds to 1 grain per imperial gallon.

Wanklyn's Scale—This system is based upon 1 part of CaCO_3 per 100,000 parts of water.

ORGANIC IMPURITIES

The organic impurities occurring in water are often the cause of a great deal of trouble due to bacterial formation known as algae. There are many different varieties of this low form of animal life, the Bacterium *Crenothrix* being quite common.

This particular form of algae is destroyed by the introduction of blue vitriol, CuSO_4 , into water. An amusing incident once came to the attention of the writer when investigating the matter of algal growth of the above type. It is well known that this form of algae thrives in the presence of iron. It was recommended that copper sulphate be added to the water in small amounts. The surprise of the investigator can well be imagined when shortly afterwards, owing to complaint that the condition was worse than at the start he was told that they had followed instructions and added copperas. This is actually what had happened: The operator having thought that copperas, a trade name for iron sulphate, or green vitriol, was the same as copper sulphate or blue vitriol, had added the former instead of the latter. The algal growth had therefore been wonderfully nourished and had increased to a tremendous amount. The addition of blue vitriol immediately served to destroy the algal growth.

The use of chlorine, as contained in bleaching powder, is largely used in the destruction of different forms of bacteria and in some cases would be necessary in textile work where water was to be used for finishing purposes. Liquid chlorine, as well as sodium hypochlorite, is also used in place of bleaching powder and yields excellent results.

FILTRATION OF WATER

Alum is used as a coagulant for organic and suspended matter and greatly hastens the rapidity of the subsequent filtration of the water. When the proper amount of alum is added to a turbid water, the alum is decomposed, a gelatinous hydrate of alumina being

formed which, as it subsides, carries down the clay and suspended matter which causes the turbidity.

Furthermore a large amount of the bacteria, present in the water, become entangled in the coagulated mass and are thus removed in the subsequent filtration.

Following the alum treatment it is customary to filter the water through a series of quartz-sand filters, either gravity or pressure.

Two general types of filters are in general use. One type depends upon the water passing, by gravity, through a filter bed composed of varying sizes of gravel and sand, the coarser material being in the lower portion and the finer sand being at the top. The water flows by gravity into the filter and seeps through same, the suspended matter gradually working through the entire system and covering the different particles composing the filter. In this type, a large filter bed is required and the best results are not obtained until the bed has been in use for some time. With proper care such a filter will last for a long time when once it is in working order.

The other type of filter is filled with quartz, coke, sand, etc. The water is treated with alum, the suspended matter in the water being retained by the aluminum hydrate which coats the material composing the filter bed. This latter filter is far more compact, and can be thoroughly cleaned by back-washing whenever necessary. This latter system finds wide application in the purification of water for manufacturing purposes.

Preliminary Report of the Estimation of Hydrosulphites and Sulphoxylates

By EDWARD L. HELWIG

Laboratory of Rohm & Hass Co., Inc., Bristol, Pa.

THE methods herein described* have been in daily use in our laboratories for over two years.

They have been compared with the other methods for the valuation of these compounds and have been found to be most satisfactory in accuracy, ease of manipulation, and in time consumed. We feel that the values obtained by the copper method represent most closely their values to the dyer. However, a more extensive investigation is now being carried on for the purpose of testing this point and to locate the causes of the discrepancies arising from different methods of analysis. The results of this investigation will be made the subject of a later report.

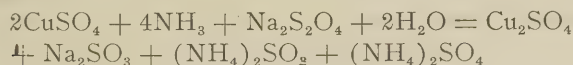
Standard Copper Solution.—The titrating solution is made by dissolving 100 grams of copper sulphate in about 1.5 liters of water, 0.2 liters of ammonium hydroxide (sp. gr. = 0.9) are added, well stirred and diluted to 2 liters. This solution is well shaken and

* Modification of the method described originally by Schnitzenberger & Risler, Bull. Soc. Chim. (2) 19, 152-156 (1872); 20, 145-159 (1873).

allowed to stand 24 hours. If a precipitate forms in the bottom of the container, it should be removed. The solution is quite stable and retains its strength unaltered for several months. Its copper content must then be determined by one of the usual quantitative methods for copper.

One gr. copper is equivalent to 1.368 gr. of sodium hydrosulphite ($\text{Na}_2\text{S}_2\text{O}_4$).

Equation:



ESTIMATION OF ANHYDROUS SODIUM HYDROSULPHITE (LYKOPON)

50 cc. of standard copper solution are pipetted into a 150 cc. Erlenmeyer flask and a moderate stream of carbon dioxide introduced during titration (2-3 bubbles per second).

Precautions.—Carbon dioxide must be washed by bubbling through water and the generator and apparatus must be flushed free of air before using the gas. The presence of oxygen will introduce a considerable error.

The glass tube delivering the gas to the Erlenmeyer flask should end about one inch above the level of the liquid. The rate of flow must be carefully controlled. If too slow, the air will not be entirely expelled and if too fast, the carbon dioxide will react vigorously with the ammonia in the copper solution and liberate considerable heat. The high temperature will then decompose the hydrosulphite before it has had time to complete its reducing action.

The sample of hydrosulphite is weighed out in a weighing bottle and introduced a little at a time into the copper solution. This is best accomplished by dropping the material from the point of a small spatula. The flask is twirled a few seconds after each addition to insure solution of the hydrosulphite. Addition is continued until the blue color is just discharged. The weighing bottle and contents is then reweighed.

Note: If last addition has been too large metallic copper will precipitate.

Calculation.— $\text{Cu} \times 1.368 = \text{H}$.

When Cu—gr. of copper per 50 cc. solution.

H=Hydrosulphite equivalent of 50 cc. solution.

W=Weight of hydrosulphite consumed in titration.

$$\frac{\text{H} \times 100}{\text{W}} = \text{per cent sodium hydrosulphite in sample.}$$

ESTIMATION OF SODIUM SULPHOXYLATE FORMALDEHYDE (FORMOPON)

A 5 gr. sample is dissolved in water and diluted to

100 cc. Ten cc. of this solution are pipetted into a 150 cc. Erlenmeyer flask. A moderate stream of carbon dioxide gas is introduced during titration (see above). The standard copper solution is run in from a burette as long as it is decolorized. The flask is then heated over a free flame and the addition of copper solution continued as it is decolorized. The end point is reached when a faint blue color is not discharged by ten seconds boiling.

Precaution.—Prolonged heating may produce decolorization by loss of too much ammonia. Steam coming from flask at end of titration should smell strongly of ammonia. Long heating will also cause loss of reducing power. Therefore, in checking the titration it is advisable to run the copper solution in immediately to within 1 cc. of end point before heating solution.

Calculation:

B=Burette reading.

H=Hydrosulphite equivalent of 50 cc. of solution.

$\text{H} \times 4 \times \text{B}$

—————=per cent sodium sulphonylate formaldehyde in sample.

1.14

ESTIMATION OF BASIC ZINC SULPHOXYLATE FORMALDEHYDE (FORMOPON EXTRA)

A 5 gr. sample is dissolved in 25 cc. of ammonium hydroxide, diluted to 100 cc. and filtered through a small Buchner funnel. The first portion is discarded. Ten cc. of the filtrate is pipetted into a 150 cc. Erlenmeyer flask and titrated in the same manner as Formopon.

Calculation:

$\text{H} \times 4 \times \text{B}$

—————=per cent basic zinc sulphonylate formaldehyde in sample.

.98

During the year ending June, 1920, the imports of raw wool into the United States amounted to 427,578,038 pounds valued at \$212,848,568, classified as follows

Clothing and combing	347,168,453 lbs.
	\$183,909,984
Carpet	72,225,748 lbs.
	\$24,342,933
Mohair	8,183,837 lbs.
	\$4,595,651

During the same twelve months there was exported 6,890,669 pounds of wool valued at \$4,658,909.

The imports of wool goods for the year were valued at \$43,537,522, the exports for the same period amounting to \$56,223,360, the excess of wool goods exports over imports reaching \$12,685,808. Before the war, wool goods exports were a negligible quantity. (The change to the present situation is the result of the war, from which the European mills are just beginning to recover.)

Standard Methods for Testing Dyestuffs

Description of a Method Which Has Given Satisfaction in Actual Practice—Methods of Testing, Recording Results and Computing Comparative Costs

By WALTER M. SCOTT, PH.D.

Head Chemist, Cheney Bros., South Manchester, Conn.

THE question of standard tests for the various types of dyestuffs is one in which the writer has been interested for a long time, with the result that, under his direction, a considerable amount of research work has been done to develop the best possible methods by which the fitness of the dyes for specific purposes might be determined. In addition to the problem of accurate testing, there was also the necessity of recording these tests so that their information might be easily available at all times.

The system which was finally adopted has proven very satisfactory for the needs of an industry which includes in its processes not only the dyeing and printing of all silk fabrics but also mixtures of silk with wool or cotton, as well as the skein-dyeing of silk and cotton. These various processes bring into play practically every known type of dyestuff, so that the flexibility of the test records must necessarily be very great. Consequently the writer believes that the system which is now presented for consideration may be applied with but few modifications, or possibly omissions, to any branch of the textile industry. In fact, already over six hundred dyestuffs, principally of American manufacture, have been so tested and recorded.

The basis of every test is naturally the standard dyeing, and a consideration of this phase of the subject leads us to a general grouping of the various dyes with respect to their method of application. In every case the attempt is made to obtain as complete an exhaustion of the color as possible, for only in this way can the standard laboratory dyeing be of real value in determining the comparative strengths of similar types of dyestuffs. The method of grouping and of laboratory testing is as follows:

CLASSIFICATION OF DYESTUFFS

Group 1. Acid Dyes.—These colors are dyed on silk in a sulphuric acid bath and give almost complete exhaustion in a very short time. In order to obtain level results it is best to enter the sample in the luke-warm dye bath, and then gradually increase the temperature to about 90 deg. Cent., at the same time adding the acid slowly in very small portions. One-half hour in the dye-bath is sufficient. All the acid

colors are best dyed at 2 per cent and the blacks at 5 per cent.

Group 2. Basic Dyes.—These are dyed on silk in an acetic acid bath. They do not exhaust as readily as the acid colors, so the dye-bath may receive its full quota of acid and be heated nearly to a boil before entering the sample. In this case also one-half hour is allowed for the actual dyeing. The more concentrated types of basic colors, such as Victoria Blue B, Rhodamine B Extra, Malachite Green and Methyl Violet, are dyed at $\frac{1}{2}$ per cent, while such others as Eosine, Auramine and Phosphine require 2 per cent.

Group 3. Neutral Dyes.—This group is in reality an offshoot of the previous one, and consists of such colors as Methylene Blue, Fuchsin and Safranin, which will dye with acetic acid but give a better color on silk by dyeing at 1 per cent in a weak soap bath. One hour near the boil is required by this type. A slight modification is made for Alkali Blue, which is first dyed at 2 per cent with soap and Glauber's salt, and then brightened with acetic acid.

Group 4. Developed Dyes.—It is hard to state any general method for this group, as the individual characteristics of the various members are strongly pronounced. Suffice it to say that the silk is dyed in a bath either with soap and Glauber's salt, as in the case of primuline, or with salt and acetic acid when working with any of the developed blacks. For a full shade a 10 per cent dyeing close to the boil for an hour is required, and the color is then diazotized and developed in the usual manner, using beta-naphthol for primuline and developed B for the blacks.

Group 5. Direct Dyes.—The standard dyeing for these colors are made on a cotton-back satin so that the behavior of each individual dye toward both silk and cotton may be demonstrated. It was found that the best bath for this purpose should contain both soap and Glauber's salt, or common salt, and the sample immersed for one hour near the boil. All members of this group are dyed at 2 per cent with the exception of the blacks, which give the best results at 5 per cent.

Group 6. Sulphur Dyes.—Standard dyeing at 5 per cent for both colors and blacks when the dye is in powder form.

Group 7. Vat Dyes.—Standard dyeing based on 5 per cent of the powder.

Group 8. Mordant Dyes.—Dyed at 2 per cent (if in powder form) on samples mordanted with chrome or alum.

The members of these last three groups are so individually distinctive that each has to be separately studied. The only generalization which can be made is that the sixth group are dyed in a bath reduced with sulphide of sodium and containing a high percentage of salt; the seventh group are reduced with caustic soda and hydrosulphite; while the eighth group are best applied in an acid medium to the previously mordanted sample.

CHARACTER OF TESTS

Having obtained these standard dyeings either on a skein or patch, the sample is then divided into six portions. One is reserved for mounting and the others are subjected to five general tests, as follows:

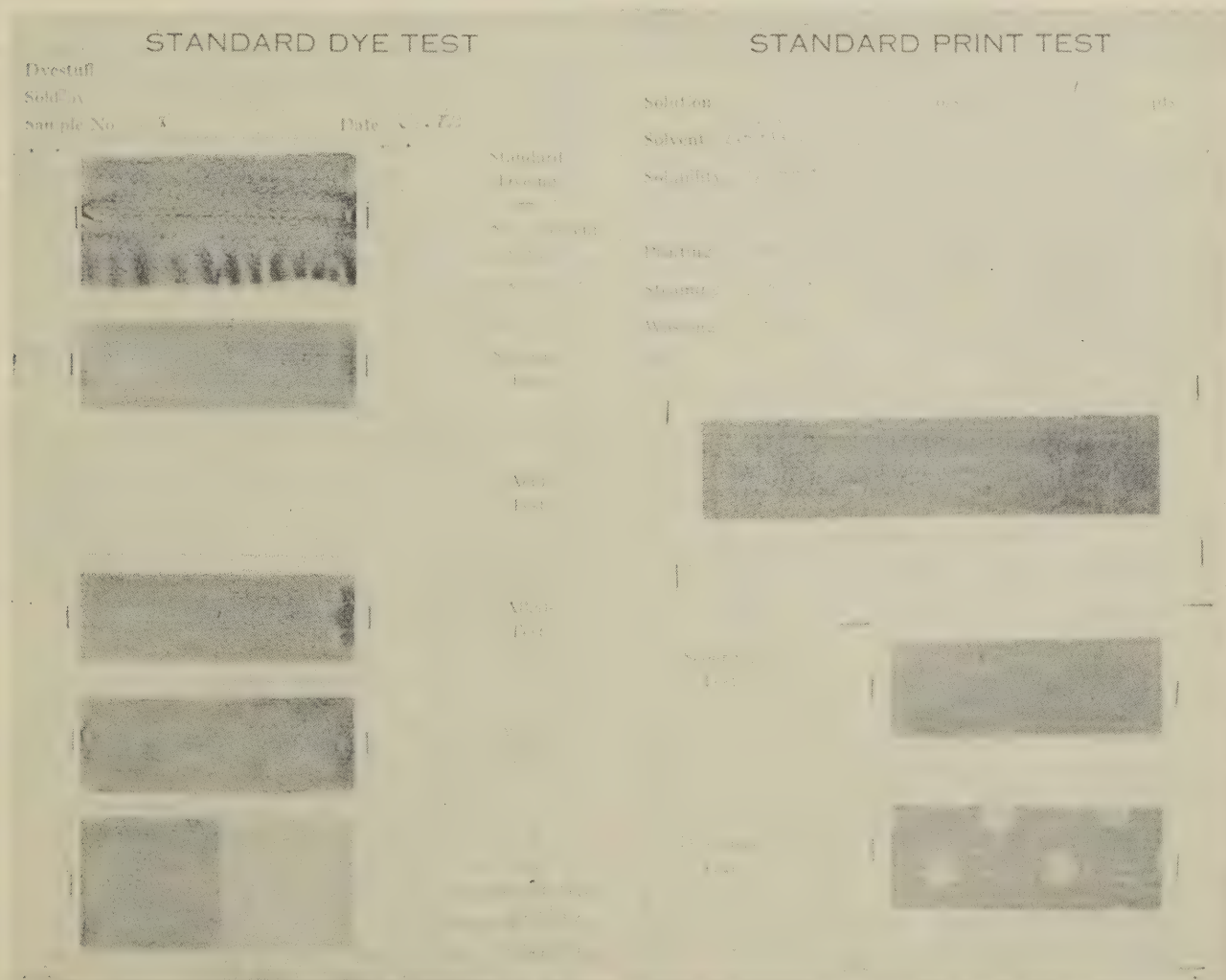
1. Scouring Test.—Immersed in soap solution fifteen minutes at 120 deg. Fahr.; 1 per cent for acid colors and 10 per cent for all others.

2. Acid Test.—Immersed in 1 per cent sulphuric acid for five minutes, cold.

3. Alkali Test.—Immersed in 1 per cent sodium carbonate solution for five minutes, cold.

4. Water Test.—Immersed in cold water for sixteen hours.

5. Light Test.—To obtain a standard test by which to compare the relative fastness of all dyestuffs toward fading, a search was made for a color which would fade uniformly and fairly fast. After eliminating a number of possibilities, the choice finally rested on Victoria Blue B. A standard dyeing of this blue was exposed under glass to one hundred hours of June sunlight as closely as it could be estimated, care being taken to allow good circulation of air around the sample. The deep blue was changed to a distinctive light bluish gray, which then became the standard for fading. A strip from a standard dyeing of Victoria Blue B is put out with every set of samples, and they are exposed until the blue reaches the standard shade of gray. Thus, no matter what the season of the year or the state of the weather, all dyestuffs are subjected to approximately the same fading action.



THE PHOTOGRAPHIC REPRODUCTION DOES NOT SHOW ACCURATELY THE RELATIVE FADING OF SWATCHES. THE EDGES OF PRINTED SAMPLES ARE PRACTICALLY LOST

Of equal importance with the dyeing properties is the behavior of a dyestuff in printing. The standard print test is made in the strength of one ounce of color dissolved in one pint of water, or a mixture with some other solvent if necessary, and thickened with one pint of heavy gum solution. If the color is acid or basic it is printed on a silk patch; if direct, it is tried out on both silk and cotton. The best pattern with which to demonstrate the strength and general printing qualities of a color is a stripe, preferably about three-quarters of an inch in width. It has been found best to steam the printed patch in the regular steam boxes of the plant, because no matter how well regulated a laboratory equipment for this purpose may be it is impossible to continuously duplicate plant conditions. The subsequent washing and finishing may safely be carried on in the laboratory.

The standard print is subjected to two tests—the scouring test and the discharge test. The former is accomplished by immersion in a 5 per cent soap solution, five minutes at 160 deg. Fahr., while behavior toward discharge is determined by printing a small polka-dot pattern on top of the stripe, using a 20 per cent hydrosulphite solution thickened with gum. This patch is also put through the regular plant process, with the exception of the final washing and drying.

RECORDING RESULTS OF TESTS

Having completed these routine dyeing and printing tests, there is the problem of recording them so that the information may be easily accessible. We believe that this is best accomplished by mounting

them in a flexible cardboard folder. This is very easily done if the dyeing has been made on a patch, but is also perfectly feasible if a skein was used. A convenient size is 10 x 8 inches, which when folded gives two 5 x 8 pages. One page is devoted to the dye tests, showing the standard dyeing at the top, followed by the scouring, acid, alkali, water and sun tests directly beneath, each test being represented on a 3/4-inch strip or a short length of a skein. On the opposite page is shown the standard print test, together with the scouring and discharge tests. Space is here left for remarks concerning the solubility of the dyestuff and its behavior in printing, steaming and washing.

The folder is placed in an envelope of heavy manilla paper, opening at the top, on the outside of which appears information concerning the name of the dyestuff, its maker, classification and file number. It is also found useful to record on the envelope the latest quotation received for this particular dye and a brief digest of the tests as shown in the folder, together with remarks on the outcome of its practical trial in any department of the plant. A typical envelope and folder are shown in the accompanying illustrations.

The tests are grouped according to the dyeing properties and the shade of the various colors, and placed in this manner in a cabinet file, with the result that all the members of one type may be readily compared. For example, there is one group of direct reds, another group of methylene blues, another group of acid oranges, etc. For reference purposes a card index with all the dyestuffs filed alphabetically, according to the firms who offer them for sale, is a convenient adjunct.

The beauty of such a system of records is in its flexibility. It is possible to make any special tests that may be desired, such as perspiration, ironing, fastness to chlorine and test for mixture, and place these with the folder in the envelope, so that there appears in compact form a complete history of any dyestuff. Or if it is thought necessary to try out this color on some other fiber than that utilized for the standard dyeing, another folder may be mounted and placed in the same envelope.

COMPUTING COSTS

In concluding the examination of any dyestuff, particularly if several of the same type are available from various sources, the final decision for purchase should be based on a very carefully conducted cost test. In this test sample patches or skeins are dyed, under identical conditions, with the dyestuffs in question, the percentage of color varying inversely with the prices quoted. A comparison of these cost tests gives the most reliable information concerning the money value of one dye as compared with others in its class.

Form O 755-1a					
DYESTUFF Acid Violet 5 B					
SOLD BY					
GROUP Violet Acid #1			FILE No. 28		
PRICE : Latest Quotation		\$7.00	4.50	4.50	
Given In Letter Dated		3/3/19	7/17/19	6/3/20	
Remarks					
LABORATORY TESTING		Sample Received 3/10/19			
		Preliminary Test Reported 3/24/19			
Dye test completed		Fastness to Light		P	Scouring P
Acid --- Alkali 0 Water G					
Print test completed		Discharge		+	Fastness to Soap P
Remarks					
PRACTICAL TRIAL		Date Ordered			
		Amount Ordered			
		Arrival Reported			
PIECE DYEING		Report			
Test Ordered					
Test Reported					
YARN DYEING		Report			
Test Ordered					
Test Reported					
VELVET DYEING		Report			
Test Ordered					
Test Reported					
COTTON DYEING		Report			
Test Ordered					
Test Reported					
PRINTING		Report			
Test Ordered					
Test Reported					

ENVELOPE TO CONTAIN DYE TEST CARD SHOWN ON PAGE 15

Papers Presented Before Dye Division of American Chemical Society

September Meeting in Chicago Affords Opportunity for Dye Chemists to Hear Many Interesting Addresses—Beginnings of True Creative Work Noted

THE fall meeting of the American Chemical Society, held in Chicago during the week of September 6, and in particular the sessions of the Dye Section at the University of Chicago on Wednesday and Thursday of that week, was the occasion for the reading of many papers of interest to the dyestuff fraternity—especially to those who are eager to detect evidences of the ability of American dye chemists to contribute original matter to the store of dyestuff knowledge. An examination of the abstracts of some of these papers, which are given herewith, will convince the skeptical that American resreach chemists have made at least a beginning along lines hitherto uncharted by their European predecessors.

A general account of the meeting was covered by *The Reporter* in its issue of September 13. At that time, however, we announced that abstracts of the papers read before the Dye Section would be given in the Technical Supplement for October. Outlines of the papers presented, with some quotations therefrom, will be found on this and succeeding pages. Readers who are interested in obtaining complete copies of any of the addresses can, in most cases, secure them through R. Norris Shreve, secretary of the Dye Section, American Chemical Society, 43 Fifth Avenue, New York City. Abstracts of the papers follow in the order in which they were read:

NEW NAPHTHALENE DYES

By Dr. A. S. Wheeler, University of North Carolina

New naphthalene dyes which color silk and wool directly in brown tones ranging from reddish to yellowish were described by Dr. Wheeler.

"The tones," said he, "vary with the reaction of the bath and also may be modified considerably by the use of mordants.

"The sulphonation of naphthalene with fuming sulphuric acid," continued Dr. Wheeler, in describing the method of making these colors, "is so regulated that from the naphthalene 1.5-disulphonic acid is obtained. This is fused with caustic soda, and the resulting naphthol is oxidized with chromic acid to juglone. This hydroxynaphthoquinone yields a wide variety of halogen derivatives; additional products at low temperatures, and substitution products at high temperatures. These are dyes, since they contain both the chromophore and auxochrome groups.

"Both chlorine and bromine derivatives of juglone have been prepared. Tribromojuglone is obtained in yields of nearly 100 per cent of the theoretical, is rich

red in color, while its sodium salt is indigo blue. The new work in this field includes the preparation of some ethers, methyl ether, brick-red crystals, its sodium salt being difficult to prepare; ethyl ether, yellowish red needles, its sodium salt being readily made. The influence of the alkyl radicals is to cause the dyes to become reddish in tone."

APPLICATION OF MALEIC AND FUMARIC ACIDS AND THEIR SALTS IN THE TEXTILE INDUSTRY

New applications of maleic and fumaric acids and their salts in the dyeing of fabrics were described at length by Dr. J. H. Carpenter, of the technical service department of the Barrett Company of New York.

Dr. Carpenter said that these acids can now be manufactured on a large scale by the direct oxidation of benzol with air in the presence of a catalyst. Thus their possible production depends upon the supply of benzol available.

"Maleic acid," he said, "is important because it may serve as a basis for the manufacture of many hitherto rare compounds. The very fact that this discovery was made and developed in the United States should make it of special interest to our chemists and should stimulate efforts in finding commercial outlets for these acids. In this paper therefore I wish to primarily consider the possible applications of these two acids, which are characterized as isomeric dicarboxylic, to textile dyeing and finishing. This is a subject which to our knowledge has never been extensively investigated because these materials have not been available in commercial quantities."

Dr. Carpenter said that actual applications of these acids and their acid salts have been made in the dyeing of woollens under the following divisions: Mordanting "assistant" for chroming of wools; the development of color of acid dyes; retarding the deposition of color in dyeing with such dyes as fast woolen cyanones; wool printing.

He said that laboratory investigations have been undertaken with these acids and their salts, and that very interesting and encouraging results have been obtained.

"The above-mentioned investigations," said Dr. Carpenter in conclusion, "give some very definite ideas as to where we can expect commercial outlets for these new acids and acid salts, but, on the other hand, it may readily be seen that promotion of these materials in the textile industry is a problem still in its

infancy and that there is much more work to be done before any comprehensive outline can be given. The results gotten in their applications as mordanting "assistants" in the dyeing of woollens with chrome colors look especially encouraging, and we feel that there are some real possibilities for the use of these new materials. We will be glad to furnish samples of these acids to manufacturers who desire to make investigations of their own. We are also in a position to render some technical service and desire to do everything that is possible to stimulate investigations for the various uses of these different materials."

THE ANILIDES OF BETA-OXYNAPHTHOIC ACID

By E. R. Brunskill
Cincinnati Chemical Works

If, instead of Beta-oxynaphthoic acid, the anilide is used for dyeing by the ice process, the colors produced are brighter in shade and much faster to washing.

A comparison is made of Beta-oxynaphthoic acid, the anilide, toluide and p-chloranilide, coupled with aniline, p-nitraniline, para-toluidine, meta-nitro-para-toluidine, para-chloraniline-o-sulphonic acid, and o-chlor-p-toluidine sulphonic acid.

The anilides were made by a process very similar to those described in the various German patents.

One mol. Beta-oxynaphthoic acid (in grains), one mol. of amine and 1,400 c.c. of toluol were heated to gentle boiling under a reflux condenser. Then, with stirring, the theoretical quantity of phosphorous trichloride was slowly dropped in. The evolved hydrochloric acid gas was absorbed in water, and the reaction was ended where no more was evolved. The mixture was poured into water, the toluol drawn off. The water was made alkaline with soda ash, in which solution the anilide is insoluble. After filtering and washing, the anilide is dissolved in the necessary quantity of caustic soda and water at about 50 deg. Cent. A relatively large volume is required. The solution is filtered and precipitated with acid, whereby a very pure product is obtained. The anilides are very slightly soluble in alcohol and toluol, while the Beta-oxynaphthoic acid is quite soluble. The anilides melt or char above 200 deg. Cent. They are soluble with a yellow color in dilute caustic.

The ordinary methods of dyeing were tried but, owing to the slow coupling properties of the anilides, good results were not obtained. The method used was as follows:

The cotton, which has been boiled out with soap and thoroughly rinsed, is soaked for an hour in a 2 per cent solution of the anilide in the theoretical amount of caustic. The diazo solutions in the meantime are prepared in the usual manner and made to a concentration of 0.1 mol. in 500 c.c. An ice-cold saturated salt solution is also made, to which is added enough soda ash to make a 3 per cent solution. This is filtered to remove the precipitated CaCO_3 , BaCO_3 and MgCO_3 .

To dye a 10-gram skein, 500 c.c. of the salt solution is measured into a liter beaker. The thoroughly wrung skein of treated cotton is immersed in the salt solution and immediately 80 c.c. of the diazo solution is added, with constant turning of the cotton. The cotton is turned from one-half to one hour, then is rinsed, first in cold water, then in hot soap solution, and finally in warm water. In the developing bath a test should show a slight excess of alkali and of diazo compound. If not, more of the one which is lacking should be added for another dyeing, as the best dyeings are obtained only by adding all the materials at once.

All the colors made with Beta-oxynaphthoic acid and those made from sulphonated amines bled very badly on washing. These were therefore treated in the following manner:

The damp rinsed dyeings were dipped into a 3 per cent solution of CaCl_2 and allowed to remain about one-half hour at 50 deg. Cent. They were then rinsed out and dried. In most cases, especially the colors from the sulphonated amines, the bleeding was completely stopped and the brightness of the colors was also increased.

THE EDUCATION OF THE RESEARCH CHEMIST

By Robert E. Rose, Ph.D.

E. I. Du Pont de Nemours & Co. Chemical Department

A summary of Dr. Rose's remarks is as follows:

The research men turned out by the educational system of this country are excellent—this has been shown by the way the dye chemists have succeeded.

If fault can be found with the system, it is with its failure to train the senses systematically during childhood, and with the emphasis placed on memory courses and second-hand data.

We shall have a higher average of research attainment when we appreciate the national importance of the grade-school teacher and give the calling the dignity it merits.

Our universities need to escape from "textbook" teaching and our research geniuses need to be freed from routine duties, though research is only the use of the results of accurate observation as material for logical reasoning, yet to produce those who can observe rightly and think clearly is the most difficult educational problem. The American Chemical Society might aid materially by organizing a section devoted to research training, where teachers and technical men could exchange views.

DETECTION OF SOME SUBSTITUTED SULPHONIC ACIDS

By D. F. J. Lynch

Color Laboratory, Bureau of Chemistry

In the work on substituted sulphonic acids in this laboratory the need of some quick method of detection (Continued on page 23.)

tion and identification for such acids is 1-8 dinitro naphthalene 3-6 disulphonic acid, 1-8 diamino naphthalene 3-6 disulphonic acid, 1-amino 8 naphthol 3-6 disulphonic acid (H acid), and 1-8 dihydroxy naphthalene 3-6 disulphonic acid (chromotrope) was felt.

We encountered mixtures of these acids in our work on the nitration of 2-7 naphthalene disulphonic acid and the subsequent reduction and hydrolysis of the nitro compound formed. Each of these four acids can be identified in the presence of the other three by the formation of salts with organic bases.

(See table at foot of page.)

As seen from the table, cymidine hydrochloride gives a precipitate with the dinitro acid only. The confirmation of the presence of this acid can be made by adding lead nitrate or benzidine hydrochloride and the formation of the respective salts. H acid forms an insoluble salt with pseudo-cumidine hydrochloride. The presence of H acid can be confirmed by the formation of the alpha naphthylamine salt. The only interference occurs between the dinitro and chromotrope acids. The possibility of these two acids being present in one working mixture seems to be nil. With such a mixture, however, all the dinitro acid can be removed with a large excess of cymidine hydrochloride. After filtering, boil down the solution to its original volume. Then on adding benzidine hydrochloride solution the distinctive benzidine-chromotropic acid salt is thrown down. The diamino acid forms an insoluble salt with cobaltous chloride, and, as seen by the table, this alone identifies the diamino acid. The presence of the other three acids does not interfere with this precipitation.

Analyses of these salts are now being made.

BENZENE DISULPHONIC ACID FROM BENZENE MONOSULPHONIC ACID

By C. E. Senseman

Color Laboratory, Bureau of Chemistry

Barium benzene monosulphonate is treated with concentrated sulphuric acid at temperatures of 220,

250 and 280 degrees. The quantities of acid used range from 50 per cent excess to 700 per cent excess. The duration of the various experiments is from eight to ten hours.

The progress of the reaction is determined in each case by removing a sample at the end of each hour and analyzing for the disulphonic acid.

Vanadium pentoxide and sodium sulphate are tried out as catalysts. In some cases an increased yield of 20 per cent results.

QUALIFICATIONS OF ORGANIC CHEMISTS

By M. L. Crossley

Calco Chemical Company

So greatly have the responsibilities of the chemist increased that still greater training and experience as qualifications of the organic chemist are essential. Mr. Crossley said that uniformity of action by men who employ chemists in passing upon their qualifications was especially needed. "I am of the opinion," said he, "that in addition to the training which a man receives fitting him as a chemist, he should also have a definite amount of experience before he is considered a chemist to qualify as such, and should have a university training or its equivalent in the fundamentals of chemistry, physics and mathematics, and in addition have had at least five years' experience in a research laboratory connected with either the university or an industry."

STANDARD LABORATORY EQUIPMENT

By C. B. Ogilvie, G. S. Simpson and M. L. Crossley

The value of having laboratory equipment of standard quality was urged in a paper presented jointly by the above collaborators.

"In order to secure accuracy and efficient results in analysis in organic research laboratories," said the authors, "it is imperative that we use standard equipment in which the factor of equipment error is reduced to a minimum. We propose two such pieces of

	Benzidine-HCl	Naphthyl-amine-HCl	Pseudo-Cumidine-HCl	Cymidine-HCl	Lead Nitrate	Cobaltous Chloride
	Immediate Ppt. Wait 5 Minutes				Immediate Ppt. Wait 5 Minutes	
1-8 Dinitro-Naphthalene-3-6-Disulphonic Acid	No Ppt.	No Ppt.	No Ppt.	Ppt.	No Ppt.	No Ppt.
1-8 Diamino-Naphthalene-3-6-Disulphonic Acid	No Ppt.	No Ppt.	No Ppt.	No Ppt.	No Ppt.	Ppt. of Cobalt Salt
		Ppt. on Standing. Wait 5 Minutes				
1-Amino-8-Naphthol-3-6-Disulphonic Acid	No Ppt.		Ppt. Wait 10 Minutes	No Ppt.	No Ppt.	No Ppt.
	Immediate Brown Ppt. Wait 10 Minutes					
1-8 Dihydroxy-Naphthalene-3-6-Disulphonic Acid	No Ppt.	No Ppt.	No Ppt.	No Ppt.	No Ppt.	No Ppt.

standard equipment for laboratory purposes, first a diazotization burette. This is a jacketed burette which can be cooled to any desired temperature by circulating brine and which can be used for diazo solutions easily decomposed by light. The burette is similar to a condenser of the shell-back type, having a blue line on a white background. The lower end of this burette should be made of capillary tubing so that only a small volume of solution is held in this portion of the burette. The burette is sealed in a condenser tubing, care being taken to avoid an exposure of much of the burette surface. The inlet and outlet tubes for circulating the brine solution through the jacket are so placed as to allow the water to surround the entire burette. It is protected from the direct rays of light by standing the jacket, leaving only sufficient exposed surface of the jacket to enable the operator to read the volume of the solution.

"Second, a standard stirring equipment for use with volatile liquids. We propose laboratory stirring equipment to be used for either the extraction or mixing of volatile liquids, consisting of a wide-mouth flask fitted with thermometer and glass stirrer driven by a shaft which extends through a condenser. This vertical shaft is supported from a 1-inch horizontal shaft 36 inches above the bench. The vertical shaft is supported from the wall by iron bearings and placed 7 inches from the horizontal shaft."

DANGER OF RARE CHEMICAL REACTIONS

By M. L. Crossley
Calco Chemical Company

Warning against a dangerous chemical reaction which has recently caused several fatal accidents was sounded by Mr. Crossley, who spoke on the action of sulphuric acid on nitrocarbocyclic compounds, which are likely to occur in extensive chemical operations.

"Certain nitro compounds," said he, "react with sulphuric acid under the certain conditions with explosive violence, producing aminophenol, sulphonic acids and complex compounds of unknown composition. The reaction is exothermic and is quite general. The temperature at which the reaction takes place is just a few degrees above that at which the substances remain in contact unchanged. It is the purpose of this paper to emphasize the dangerous character of this reaction especially when the reacting mass is large and is confined in a vessel with a closed top. On a manufacturing scale it is extremely difficult to control this reaction and it should be guarded against in processes where it might be secondary to some main reaction. A few months ago this reaction was brought about by accident in a plant in this country and it resulted in a bad explosion in which several men were badly injured and one man killed. It is hoped that other manufacturers will profit by this experience and thus prevent loss of life and property which would otherwise result."

THE PREPARATION OF LEPIDINE AND RELATED BASES

By Louis A. Mikeska
Color Laboratory, Bureau of Chemistry

Recent developments in the field of photosensitizing dyes have brought lepidine and related bases again into prominence. A procedure was given for the preparation of lepidine, p-tolulepidine and p-ethoxy-lepidine.

SYNTHESIS OF PHOTSENSITIZING DYES (II), DICYANINE A

By L. A. Mikeska, H. L. Haller and E. Q. Adams
Color Laboratory, Bureau of Chemistry

Directions were given for the preparation of 2,4-dimethyl-6-ethoxyquinoline from p-phenetidine; for the preparation of the ethiodide of this base, and, from it, the nitrate and iodide of Dicyanine A.

ISOCYANINE DYES FROM LEPIDINE AND ITS HOMOLOGS

By Elliot Q. Adams and Herbert L. Haller
Color Laboratory, Bureau of Chemistry

The quaternary addition products of sufficiently pure lepidine (or homologs of lepidine) give, when treated with alcoholic alkalis in hot, concentrated solution, dyes of the isocyanine type, similar to but not identical with those given by the corresponding derivatives of quinaldine.

The preparation of five such dyes is described.

The formation of isocyanines from lepidine confirms the hypothesis, now generally accepted, that these dyes contain two quinoline nuclei attached to a central carbon atom in positions 4 and 2, respectively.

NAPHTHALENE SULPHONIC ACIDS (III).

An Alternative Method for the Qualitative Detection of Naphthalene 2-7 and 1-6 Disulphonic Acids

By J. A. Ambler
Color Laboratory, Bureau of Chemistry

In "Naphthalene Sulphonic Acids (II): A Method for the Qualitative Determination of Some of the Naphthalene Sulphonic Acids," by J. A. Ambler and E. T. Wherry, read at the meeting of the American Chemical Society at St. Louis in April, a method of detecting naphthalene 1-6 and 2-7 disulphonic acids by a microscopic examination of their B-naphthylamine salts was given. It is also possible to detect these two acids in mixtures by the different solubility of their B-naphthylamine salts in four volumes of 95 per cent alcohol and one volume of water, the 2-7 salt being more insoluble. The 1-6 acid is detected by converting to the sodium salts and subsequent treatment with sulphuric acid, in which the sodium salt of the 1-6 acid is more insoluble.

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY

PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL

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PANAMA, PRUSSIAN INTRIGUE, AND THE DYE INDUSTRY

Had the governments of the Allies not been blind to the explosives industry concealed within the apparently purely commercial and innocent German dye industry, they would have stopped at nothing in their efforts to prevent the growth of the world-monopoly acquired by the Teutons. Having been made aware, by sudden and desperate need, of this "incredible blindness," they subsequently abstained from exposing their almost criminal negligence toward the peoples whose interests they existed only to safeguard. The general scheme of war preparation carried on by Germany—or perhaps it would be better to say by the Junker Oligarchy—was not, however, confined to the dye industry alone, but extended in a bewildering maze of unwholesome fronds and tendrils, all reaching back to the thick stem growing out of the Wilhelmstrasse, far out into the political, social, religious and economic life of many nations, and so cunningly was it insinuated in each case as to be almost inextricably bound up in and completely hidden by the very local passions and prejudices through which it operated. It would be the greatest folly to assume that these plots have ceased because of an apparent change in the government of Germany; on the contrary, there is every necessity for organizing at once to erect a barrier against the intended recurrence of past crimes.

Just how the Prussian master minds carried on some of these subtle means of preparation for 1914, and more particularly how they connived to wreck the French Panama Canal project as conceived by de Lesseps, incidentally brewing bad feeling between France and the United States, and how they schemed to secure control of the Canal under the guise of a "strictly Colombian corporation," is most interest-

ingly set forth in "The Great Adventure of Panama," by Lieut.-Col. Philippe Bunau-Varilla, some of whose conclusions appear in the sentences of the preceding paragraph. Because of the intense interest which every reader of The REPORTER is certain to feel in this book, just published by Doubleday, Page & Co., we take this opportunity of directing attention to it in these columns.

The author, once chief engineer of the old French Panama Canal Company in 1885-1886, and later first Minister Plenipotentiary and Envoy Extraordinary of the Republic of Panama to Washington (1903-1904), saved the Canal for the world by inaugurating the "bloodless revolution" against Colombia which enabled the little State of Panama to come into being and eventually make its own treaty with this country. In his story of the early schemings which centered around the Canal project he most unexpectedly brings the German dye industry upon the scene, and it is our purpose to reproduce here for the benefit of readers what he has to say of its purposes and effects. The point to be remembered while perusing this matter is that, as an engineer and as a figure in international politics, the author's personal interest in the dye industry was nil, save as it came directly under his notice as a student of Prussian intrigue for ascendancy. Yet he thought it important enough to devote the entire second chapter of his book to the subject, which he heads "The Encirclement of Germany's Enemies by the Dye Industry."

Everyone knows of the great victory achieved by the famous French "75's" as employed by "Papa" Joffre at the first battle of the Marne against the German machine guns. It was the hydro-pneumatic brake, which took up the recoil and returned the gun to its original position, which made the "75" so efficient, and we regret that the limited space at our disposal does not permit us to give here an outline of the dramatic circumstances under which France was secretly equipped with this gun and German spies tricked into recommending for their own "77's" the adoption of the steel spring recoil system, vastly inferior. This is all described in the first chapter, and we trust that many will be sufficiently interested to get the book and read for themselves. Suffice it to say that France entered the war with the better gun and a better type of shell, but only a few weeks' supply of high explosives, whereas Germany, because of her dye industry and her successful commercial process for the fixation of atmospheric nitrogen, could make plenty of explosives within her borders, being relieved of dependency on Chile for nitrates. The relation of the Panama Canal to the world struggle will at once become apparent, and we now invite the reader to consider Chapter II of Bunau-Varilla's book, which follows:

The romantic story of the adoption of the hydro-pneumatic brake for the "75" by France, and of the steel spring for the "77" by Germany, is typically

French. Resourcefulness, quickness of decision, scientific spirit, cleverness of action, devotion to duty in the highest sense of the world—all that is to be found in the preceding lines.

In those that follow we shall see, on the opposite, the French faults. The incredible blindness of her administration, the complete lack of method, of system, and of initiative in a question of such capital importance is simply amazing. All the advance which the French genius, the spirit of self-sacrifice of her first magistrate, had given her was almost reduced to naught by the incredible torpidity of her government.

We have seen that the invention of Turpin had made it possible to fill the shells of the "75" with a high explosive, melinite. France owed to the irradiating brains of her sons the possession of the best field gun and the best shell. She entered the war, which was unchained in 1914 by the criminal ambition of the Teutonic Knights, with about 4,000 "75" guns. She had some ammunition to begin with, but for the all-important melinite she had to get the greater part of her new supplies from sources outside of France. It may seem beyond belief, but this source was—Germany!

This seems incredible, but it is a fact!

The blindness of the French Administration, the deceiving songs of the pacifists as to the impossibility of a European war, had gradually led France to get engulfed in the methodic and devilish entanglements of the German dyestuff industry.

HYPOCRISY OF THE PEACEFUL DYE INDUSTRY

The terrible situation in which France, as well as Great Britain and Russia, was placed by the lack of ammunitions after the earlier battles of the war is explained thus:

"Who makes dyes to-day can to-morrow make high explosives—with the same men, with the same plant, with the same materials—provided he disposes also of oxidized nitrogen."

The dye industry and the high-explosive industry are so intimately connected as to be virtually one. In fact, melinite and trinitrotoluene are nothing but hydrocarbides, extracted from distilled coal tar, in which is incorporated oxidized nitrogen.

Germany had established all over the world the monopoly of her apparently innocent dye industry. It was the scientific noose which was going to strangle all her enemies after the first months of war owing to the famine of explosives.

The vile methods of warfare admirably condensed by the celebrated Count Luxburg, the minister of Germany to Argentina—suggesting neutral ships should be sunk "without leaving traces"—were also followed in peace. The same men who enjoyed the hospitality of the United States, while depositing bombs with time fuses in the ships leaving the American wharves, were active during peace times also.

The dye industry being for everybody, except Ger-

many, a peaceful one, and, for Germany only, a war industry, it was protected against competition by German war methods.

Whenever a non-German dye appeared either in France, Great Britain or America, immediately it was stifled under an avalanche of German goods. If, however, the competitor resisted the business pressure he was soon put out of commission by purely Boche trickery.

Suitable additions of noxious substances were made by criminal hands in the mills of the users of non-German dyes. Everybody was soon convinced that non-German dyes did not possess the standard qualities necessary for their industrial use. By this double method in time of peace—dumping and sabotage—the Boche acquired the practical monopoly of the dye industry. Free-trade nations were glad of it. The innocent economists and the candid pacifists were conveniently misled while in fact the monopoly of the dye industry constituted the control of explosives by Prussia. She alone was capable of making the explosives on a large scale, when she should decide to let loose her dogs of war and to complete the task which she had begun in 1619. This monopoly was to insure her conquest of the world.

Everybody remembers the universal complaints about the absence of dyes when the war was declared by Germany. Nobody, of course, remembers any complaint about the absence of explosives. It was, however, the very same question. The manufacture of dyes was the manufacture of explosives. The various nations abstained, naturally, from exposing their incredible blindness and the almost criminal neglect of their governments in not having taken, during peace, adequate protective measures. Their stock of material for providing their artillery with high-explosive shells was practically just sufficient for the first weeks of the war.

Germany alone was capable of the industrial effort necessary to furnish the large masses of explosives required for the war. She had of the plant, she had of the personnel, she had of the raw material.

GERMANY'S DOMESTIC NITRATE SUPPLY

She had also succeeded in freeing herself from the necessity of importing nitrates from Chile. Chile, on the contrary, was the only source open to Germany's blind enemies for obtaining the oxidized nitrogen which is the essential element of high explosive, or of gunpowder.

Thanks to supreme technical efforts she had succeeded in devising the proper scientific and industrial methods to extract from the atmosphere the oxidized nitrogen necessary for the manufacture of her explosives. It is safe to say that Germany alone among the nations at war could produce an unlimited quantity of explosives on her own soil and with products generated within her own frontiers. It may be added that her enemies would have been crushed in a few

months under the strategic superiority resulting from such a monopoly if, thanks to the political conditions due to the Panama enterprise, they had not found an extended and helping hand in the United States.*

France had no chemical factory capable of providing what she needed to load her shells except in an insignificant proportion. She was, on the other hand, depending exclusively on the transportation to her harbors of the Chilean nitrates to obtain the indispensable oxidized nitrogen to make explosives at home. The negligence of her governmental administration had condemned France to an immediate lack of explosives a few weeks after the declaration of war.

The same remarks apply to Great Britain.

If the artfully engineered explosives famine in France, Great Britain, America and Russia did not suffice to insure Germany's triumph, even after her defeat at the Marne, humanity owes it entirely to the United States.

*Some time after this was written the *Daily Mail* (Paris edition) published on the 20th of August, 1919, the following: "Germany has solved the problem of the fixation of nitrogen as a commercial undertaking on a gigantic scale. In future from the point of agricultural fertilizers she is independent of any blockade. Furthermore, the plant used in the process can be turned at the shortest notice to the manufacture of high explosives."

The above is the substance of a statement made to the *Times* recently by Dr. Edward C. Worden, the explosives chemical expert of the United States, Bureau of Aircraft Production, Washington, who has just returned to London from a tour of inspection of the chemical industry of Germany

ANOTHER DEFINITION OF "FASTNESS"

In the Technical Section of The REPORTER for September there appeared a definition of "Fastness," of which we invited criticism. The following is submitted in reply to our invitation:

"Fastness" is the persistency of a coloring matter to adhere to an object. It is not even essential to first determine whether such adhesion is the result of chemical or physical phenomena.

To discuss the question "Is fastness a physical or chemical quality?" is to determine whether the dyeing process is chemical or physical. Much has been written on the theory of dyeing, and although the evidence seems to be in favor of a chemical basis, still there is enough uncertainty in the matter to admit hypotheses on the part of exponents of a physical or so-called mechanical theory.

Dyeing wool and silk with basic colors is unquestionably a chemical process. Experiments have been performed in the last hundred years which scientifically confirm this theory; in fact, so strongly that, whatever plausibility a mechanical theory may have in other instances such as dyeing cotton with direct colors, or in vat dyeing, there is no room at all for assuming a mechanical theory here.

Our friend has taken for granted that the dyeing

process is purely physical and that, moreover, it is brought about through a change in the physical structure of the fiber. It is not necessary in assuming a mechanical theory to affect same through a change in fibrous structure. Absorption or saturation may also be used to account for the mechanical theory.

In maintaining that "If no recognized reagent or process will restore the original condition, then the changed physical characteristics of the fiber are permanent and the color can be classified as fast, etc.," he has neglected to consider (1) that fastness in some cases is known to be a chemical and not a physical phenomenon, (2) that in instances where it may be considered physical no change of fiber structure need necessarily be assumed.

A further discussion of the theory of dyeing giving references to scientific deduction and and experimentation is perhaps more than you ask for, wherefore permit me, please, to step aside and make room for the next.

B. C. HEYMAN, A.M.,
United Chemical & Color Co., New York.

STANDARD DYE TESTS

On page 14 of this section there is an article by Walter M. Scott, Ph.D., head chemist of Cheney Brothers, in which the author describes the methods which he has worked out for testing dyestuff samples and recording the results of such tests. It appears that Dr. Scott has developed a very satisfactory system for his mill and we feel that many of our readers would benefit materially if they put some similar system into operation in their own laboratories.

The contribution of this article by Dr. Scott was prompted by his having read Professor Olney's "Plea for Standard Dye Tests and Standard Records," published in last month's Technical Section of the REPORTER, in which Professor Olney set forth the many advantages which would accrue to the textile and other dye-consuming industries if some generally recognized organization could be designated to make and record the results of tests of all dyestuffs on the market.

Dr. Scott has done remarkably well for Cheney Brothers, and we feel that his work in this direction must be of inestimable value to his firm—but how much better if these tests could be made by some one recognized agency where the results could be available to all dyestuff consumers! Since the publication of Professor Olney's plea we have discussed this matter with many men prominent in the textile industry and all, without exception, have manifested interest in the proposition and several have promised to support financially any general movement which might be inaugurated looking to the establishment of an official dye testing bureau.

As Professor Olney pointed out, the first essential to the establishment of such a bureau is the arousing of favorable sentiment or, as he expressed it, "the development of sufficient interest on the part of both manufacturers and consumers of dyes, but particularly the latter."

No movement for the common good ever goes by itself --some one has to get behind it and push. The REPORTER is anxious to do all in its power to promote this idea and we hope that other trade papers and manufacturing associations will help.

The idea of a standard color card was talked of for a long while before it was actually produced and even when it became an accomplished fact many manufacturers refused to take it seriously. To-day, however, the seasonal shade cards of the Textile Color Card Association are accepted as standard by a great majority of textile manufacturers throughout the United States and Canada, with the consequent avoidance of endless confusion and the saving of very large sums of money previously expended in the development of slightly varying shades by each individual mill.

MANY A SLIP—

One of the lessons which should have been well learned by certain textile interests through scrutiny of dye manufacturers' exhibits at the Chemical Exposition, was the lesson that self-interest is, in the end, inseparably bound up with consumer interest. Most men who sell things to the public know this lesson well, but occasionally there are lapses of judgment based on the old delusion that you can fool the public and not pay the penalty. It is never profitable for the reason that all the time the deception is going on, public confidence is being undermined, bit by bit, and the intended restoration becomes more tedious and expensive the longer it is delayed.

This subject has been referred to times without number, but never was there better reason for referring to it than there is now. When the war began, as everyone knows, the textile mills had to take what they could get in the way of colors for their wares and be thankful that they did not have to ask their public to accept undyed fabrics. Prices of dyes jumped, as prices will in the case of anything which is very scarce and eagerly sought after, and some tried to accuse the dye men of profiteering when they knew that it was simply a case of the activities of the dye "gyp" combined with a natural desire on the part of the textile manufacturer to outbid his neighbor and get what dyes there were for himself.

This situation was all passed on to the public via the department stores and the public accepted the situation, hoping for better results as time went on.

And as time went on, the dye manufacturers began to produce better products, and little by little they added to their repertoire the rarer and more difficult colors until to-day, while the list is not as yet complete, there is, within reasonable limits, no reason why the textile manufacturer who so desires cannot make his goods fast enough as to colors to satisfy any ordinary demands of his trade.

But between progress in the dye manufacturing industry and progress in the dyehouse there was encountered a hitch. The new dyes, as added, sold for a higher price than the inferior colors in such common use. The reason for this was the staggering preliminary outlay necessary

to the dye manufacturer for research, experimentation and equipment before he could place a superior color on the market. The textile men—or many of them—found it cheaper to buy the old colors and to tell the public that the American dye industry was falling down. A most short-sighted policy indeed!

On one hand, immediate acceptance of the new color at the price offered would speedily send that price downward as quantity production increased. Automobiles did not begin to be cheap until the public began to buy in quantity. On the other hand, although the first and higher price looks important enough to the textile man when he is buying his dyes by the barrel, the new price does not really figure heavily in the total cost of the manufactured goods per yard or per dozen. Further, use of the new color enables the textile men to offer their trade a vastly superior article, which advantage needs no enlarging upon, and above all, it acts as a powerful stimulus to the dye manufacturers to go on conquering the remaining fields.

The dye industry has had a hard enough row to hoe, what with the extreme difficulty of the problems to be overcome and the uncertainty as to what the Senate will do for its future protection, and it is the height of folly to add one minim to the burden. It is to the best interests of the textile fraternity as well as of the dye manufacturer to have the industry progress, and if through Senatorial vacillation on one side and artificial obstacles born of greed on the other, the industry should succumb, the textile industries would straightway find themselves back in their old unenviable position of dependence on foreign whims for one of their vitally necessary raw materials.

Many textile manufacturers are consistently taking advantage of the newest, even though temporarily higher-priced, products of our dye makers. But they cannot do it all; the color-consuming industries as a whole must unite in this to make it effective and send prices down more rapidly.

ADDITIONS TO DUNKER & PERKINS LINE

The Dunker & Perkins Company, 287 Atlantic Avenue, Boston, have recently added products manufactured by the Peerless Color Company, of Bound Brook, N. J., to the line of dyestuffs which they are handling. The Peerless company specializes in direct fast cotton colors and is particularly well known for its Primuline and Direct Fast Yellow FF.

In addition to the Peerless company's products, Dunker & Perkins are also selling agents for the Noil Chemical & Color Company, New York; the Holland Aniline Company, of Holland, Mich., and the Sepoy Color Company, of Scranton, Pa. Among the products of these companies a new Direct Black of the Noil company is particularly worthy of note.

Stocks of all the colors handled are carried in Boston for immediate delivery, and the company has also at the disposal of consumers an exceptionally well-equipped service laboratory.

THE DYE-WORKS CHEMIST

By B. LEECH

In the dyeing industry the gradual replacement of natural by synthetic dyestuffs has led to the disappearance of the old-time craftsman. The materials which the old dyer used were of such uncertain and variable composition, and the chemical aspect of the processes he employed was so incompletely understood, that experience and the accumulation of detailed empirical knowledge were of greater practical value than a knowledge of chemistry. As in many other industries, the necessary technical knowledge was carefully guarded, and the possession of "trade secrets" was the basis of commercial success. With the introduction of synthetic dyestuffs the dyer was offered materials which his previous experience had not taught him how to use, and he was dependent for the necessary information on the makers of the new dyestuffs. In this way it came about that all problems of the special application of the new dyes was referred to the color makers for solution, and ultimately the dyer appealed to the color maker in all cases where a difficulty arose which appeared to him to present a chemical problem. This state of affairs is well illustrated by the reply recently given by a number of dyers to an inquiry by a local education committee as to the desirability of starting classes in chemistry and dyeing in the local technical school. The reply was to the effect that the directions given by the color makers for the use of their dyes were so complete and simple that no knowledge of chemistry was required by a dyer! This surely is a policy of despair as regards the future of dyeing as an independent industry. If the art of dyeing has become so simple that anyone can carry it on without special training, competition must inevitably reduce the dyer to the position of the unskilled laborer. It would be almost equally ridiculous to pretend that the issue of drugs in tablet form, with pamphlets describing their therapeutic value and giving directions for their administration, would make special training unnecessary for the medical profession. Surely a saner view would be to regard the new synthetic dyestuffs as presenting wider opportunities for the dyer's ingenuity and invention. The dyeing and printing industries as a whole present a vastly more complicated picture from the technical point of view than that offered by these industries in the days before the universal use of synthetic dyes. The actual chemical materials now in use are much greater in number and variety; at the same time they are of greater chemical purity and less obscure and uncertain in their properties. The consequence is that the problems now presented to the dyer, though of greater variety and complexity than in the past, require for their solution a wide knowledge of chemistry and kindred sciences

rather than the special and intimate experience of his materials which the old craftsman possessed. Dyeing has, in short, become an applied science. Like other industries, the dyeing industry is in a state of transition, and very different stages of progress are represented by different works. Thus we find a large number of small dyehouses in which a very limited number of processes are used and the equipment is of the simplest; very extensive works which are specially equipped for mass production by a few processes; and finally works with a highly complex organization for a great variety of processes.

Most dye works of importance now employ a chemist, but there is still room for very considerable progress in the direction of scientific organization and control of the processes carried on. On the one hand there is a deficiency in the supply of adequately trained men, and on the other there is a failure to appreciate the value of scientific control. The dyehouse chemist is to-day employed chiefly for the analysis and evaluation of materials as a guide to the buying department, but it is desirable that he should have a far greater share in management and responsibility, and that remuneration should be offered which would attract men who are fit to take such responsibility and have a place on the board of directors. It is not generally realized that a manager who possesses no scientific training cannot employ a trained man under him in such a way as to get the greatest benefit from his services. Such a manager fails to see the opportunities for the application of scientific method which are actually under his eyes, and the problems which he passes on to the trained man are most frequently presented in a form which precludes any likelihood of the latter drawing up a report of real value. Given the trained man, the only way in which to bring him into contact with his work is to give him complete technical control and a free hand. It is often far easier to solve a technical problem than to explain it to a board of untrained directors and teach them to arrange the facts and draw the inferences in a scientific manner. However, the supply of men capable of taking responsibility is very restricted, and a much broader scientific education is needed in the technical school. When Nature presents a technical problem she has no regard for the examination syllabus. A problem which at the first glance appears to be a chemical one often involves a knowledge of physics or biology for its solution. The first requirement for the dye-works' chemist is a broad and thorough training in scientific method. In addition to chemistry he requires at least a sound knowledge of physics and mathematics, and he must be familiar with the technique of the microscope. The best training for such a man is a broad scientific course at a university, followed by special training in a technical school. At present the university-trained man knows too little of the technical side, and the technical college man knows too little of the scientific side.

It will now be interesting to pass in review some of the features in dye-works management in which the services of such a trained man, as suggested above, would prove of considerable value. His advice will be needed as to the plan and construction of buildings, the materials of the walls, roof, floor and drains, for wise decision on these points involves a knowledge of the processes for which the building is to be used. Ventilation (which is generally either very bad or immensely expensive), steam and power equipment, and the arrangements for artificial lighting also demand his attention.

Further, there is the important question of plant. The modern tendency is to dye all textile materials at as late a stage of manufacture as possible. If goods can be woven "in the gray" and dyed in the piece the output of a given number of looms is far greater, and there is much less risk of damage than if they are woven from dyed yarns. But piece-dyeing involves a great variety of machinery, and almost every one of the new fabrics which have appeared in recent years requires special machinery for dyeing and finishing. The problems involved in devising means of dyeing expeditiously a new fabric, having regard to the choice of dyestuffs and contents and temperature of the dye-liquor to which one is restricted, and the final finish which the fabric is required to have, are such as require an intimate knowledge of the properties of the dyestuffs under very varied conditions, as well as of the physical properties of the fabric and of the materials which can be used in constructing the special machinery. In this connection it may be remarked that the most conspicuous successes have only been attained when the designer of the cloth and the dyer have worked in close collaboration.

The invention of new fabrics will be a most important factor in enabling this country to maintain its pre-eminence in the textile markets. Conditions in other countries, notably the United States and Japan, are very favorable to mass-production of the more common and less complex fabrics, and the British manufacturer is being forced more and more to abandon the trade in the commoner and lower-priced materials and to turn his attention to those which present greater technical difficulties in production and command a higher price. The problems before the dyer in this respect include not only those of dyeing itself, but involve the question of chemical or physical treatment of the fabrics in very special ways, which, combined with the weave and design, produce quite novel results. The weighting of silk, mercerization of cotton and the production of artificial fibers are instances to the point. An interesting fabric consisting of a mohair warp and wool weft, of fairly recent invention, affords another illustration of the kind of possibilities that are open. The mohair warp, as it existed in the finished fabric, was too weak to stand weaving; the warp originally consisted of a mixed

yarn of mohair and cotton, and the latter was entirely removed from the piece, after weaving, by carbonization.

Another valuable part of the work of the dye-works chemist is the detection of the cause of damages which arise during one or another of the processes and the prevention of the same. Such problems almost always involve skill in chemical microscopy, and experience in this special technique is a valuable asset to the dye-works chemist. Timely use of the microscope in this way may lead to the early detection of an impurity in one of the chemical materials used or a defect in a machine and so prevent heavy loss.

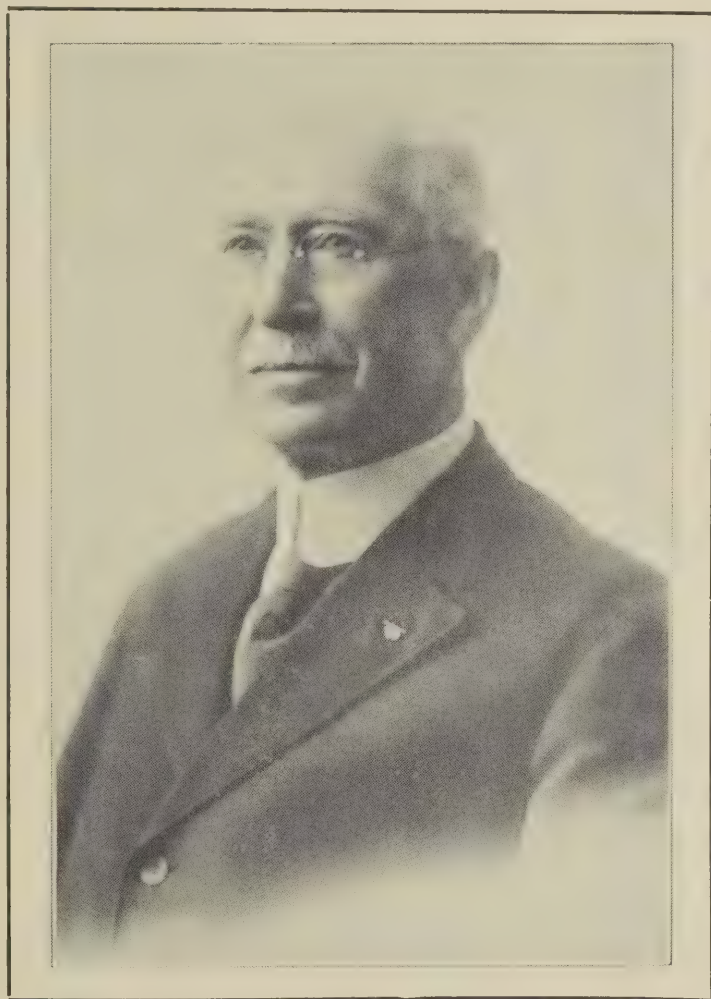
The question of large production is one which involves in the dye works many intricate physical and chemical problems. In the case of each fabric, yarn or fiber there is an optimum amount which can profitably be dyed on one machine. It is generally possible to decide on the approximate limitations without actual trial.

In the control of drying and finishing processes the trained man will find many opportunities for the application of his knowledge. To give a simple example: The difference in efficiency in the ordinary drying stove achieved by the correct control of the ventilation, based on observations of a wet and dry bulb thermometer, is very striking. The finish of a cloth varies in a very remarkable way with the conditions of the final drying, namely, the previous and final moisture content of the cloth, length of time taken, and the temperature at which drying is carried out. The difference in effect between low and high temperature drying is one of the problems which are ripe for thorough investigation. The mixings, for finishing purposes, of stiffening, softening or thickening materials and the like present a fine field of investigation to the colloid chemist. The sizing of yarns before weaving and the removal of the size before dyeing may be included in the same class of problems. Closely related are problems involving fermentation and the growth of molds on fabrics and fibers and the destructive effect of micro-organisms. The production of materials with special physical properties such as waterproofing, fireproofing, making them impermeable to gases and resistant to abnormal conditions, offers another large field of scientific problems. Finally, it must not be forgotten that we are still very ignorant of what is actually going on in the dye-bath when a textile material is being dyed.

The above short sketch of the general character of the work of a modern dyer will show that the training suggested is by no means too wide or liberal if the industry is to attain the rapidity of progress necessary to keep this country at the head of the textile trade. It will also be seen that the occupation is one in which a man of high education may find work which can be of great commercial value, and is at the same time intellectually interesting and satisfying.—*Journal of the Society of Chemical Industry.*

MEN OF MARK

in the Dyestuff Field



W. K. Robbins
Chief Chemist
and
Superintendent of Dyeing
The Amoskeag Mfg. Co.

W. K. ROBBINS, a native of the State of Iowa, was graduated in 1878, with the degree of B.Sc., from the Iowa State College, and was granted the further earned degree of M.Sc. by the same institution in 1880. In 1879 he became first assistant in quantitative and organic chemistry at the Massachusetts Institute of Technology, where he taught three college years, serving during the vacation period of 1880 as chemist to the Massachusetts State Board of Health.

In 1882 he became chemist of the Amoskeag Manufacturing Company, and in 1903 was made superintendent of dyeing, which entailed complete supervision of all coloring and bleaching operations. When the Amoskeag company took over the Manchester Mills, Mr. Robbins' supervision was extended over the worsted department, which included a small manufacturing laboratory previously run by the Manchester Mills Print Works.

In addition to exercising the functions ordinarily attached to an office such as his, Mr. Robbins has often found it desirable to manufacture certain necessary products which were not available in the open market or where the price was unreasonable. Among such items he produced sulphonated castor oil for alizarine dyeing, in 1884, and since that time extracts, soaps, sizing and finishing compounds, and even sulphur black during the war-time shortage of dyestuffs.

Mr. Robbins has always been interested in sanitary matters and has served as a member of the Manchester Board of Health for twenty-four years. He considers that the functions of chemist to a large textile concern should extend much further than the mere testing of supplies, and should include the selection of such materials as are best adapted to the work to be done in order to avoid damage to the goods in process and to promote the facility of manufacture, and that he should be occupied with the devising of new processes as well as the revising of those in operation. He believes that when a chief chemist has official authority as superintendent his opportunities to be of real service to his mill are greatly amplified.

Review of Recent Literature

"Manufacture of Violamine B." Kikuichiro Sakai, *J. Chem. Ind.*, Tokyo, 1920, p. 242-57.

In chlorinating fluorescein by the Bayer method, using PCl_5 , unless the air is very dry the HCl involved becomes a serious problem. One part of fluorescein and two parts of PCl_5 were mixed and heated one-half hour at 70 to 80 degrees and one-half hour at 100 to 110 degrees, using an oil bath. Product was washed with hot water and reprecipitated from toluene, giving a yield of 93 per cent. The chloride was then condensed with aniline in the presence of ZnCl_2 for two hours at 220 degrees, rhodamine being obtained to the amount of 150 per cent original weight of fluorescein hydrochloride. Sulphonation was carried out with 40 parts anhydrous H_2SO_4 and 5 parts of the rhodamine at 20 degrees, the yield of violamine B being about 116 per cent. When higher temperature or stronger acid is used the disulphonic acid would be formed. A satisfactory lake was made with 10 parts of the violamine B, 57 parts NaOH , 12 parts BaCl_2 , 10 parts of alumina and 20 parts of alum.

"Linen." Alfred S. Moore; 130 pages, $4\frac{1}{2} \times 7$; Isaac Pitnam & Sons, New York; \$1.00.

The author has condensed a remarkable amount of material into very little space in this latest addition to the series of "Common Commodity" handbooks. The work is not extremely technical and is designed to be of interest to the layman as well as to the mill man. The following subtitles are employed: History; Irish Trade; Raw Material; Preparing the Flax; The Spinning Mill; Winding, Warping and Weaving; Bleaching and Finishing; Varieties of Linen; Grading Linen; Making Up and Marketing; Conditions of Work; Combination and Wages.

"The Absorption of Colouring Matters by Charcoal." Edmund Knecht, *Journal of the Society of Dyers and Colourists*, 36, 201 (1920).

In referring to statements made by Philip Dunhill and Workman in a recent paper published in the *Journal of the Society of Dyers and Colourists*, entitled "The Activation of Wood Charcoal by Heat Treatment," Mr. Knecht takes exception to certain of their findings. The authors give an account of results obtained after prolonged heating of wood charcoal to temperatures of from 800 to 925 deg. Cent. on its affinity for Methylene Blue, which they find to be greatly increased by the treatment. Neither specific gravities nor analyses of the charcoals are given, yet the authors feel justified in making the following statement: "Attempts have been made to correlate the activity of a charcoal in decolorising solution with its nitrogen content, but the probability of any such relationship must be regarded as exceedingly small in

view of the above figures for a wood charcoal." Knecht says that the authors could not have read his previous paper carefully, for he never claimed that the nitrogen content of charcoals had any influence upon their absorptive power for Methylene Blue, which he chose for the experiments as a typical basic color. In fact, it was specifically stated that the percentage of nitrogen did not appear to affect this property. The original contention was that the absorptive power of an animal charcoal for an acid color is (for a given sample) proportional to the amount of fixed nitrogen which that charcoal contains, and this contention has been in noway disproved. The author still holds that the absorption of Methylene Blue is in some way connected with the oxygen content of the charcoal, and until there is definite proof that pure amorphous carbon will act in this way the phenomenon must be attributed to chemical and not to mechanical causes.

"Hosiery Manufacture." W. Davis, M.A.; $5\frac{1}{4} \times 8\frac{1}{4}$; Isaac Pitman & Sons, New York; \$3.50.

The principles of knitting and the structure of knitted fabrics are described, together with an explanation of the calculations commonly employed in knitting hosiery. Raw stocks and yarns are also described in detail. The volume is of convenient size and should be of value to the knitting mill superintendent. The following titular subdivisions are employed: Development of the Knitted Fabric; Knitting and Weaving Compared; Latch Needle Knitting; Types of Knitting Yarns; Systems of Numbering Hosiery Yarns; Calculations for Folded Knitting Yarns; Bearded Needle Knitting; Setting of Knitted Fabrics; Various Knitting Yarns; Winding of Hosiery Yarns; Circular Knitting; Color in Knitted Goods; Color Harmony and Contrast; Defects in Fabrics.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the **AMERICAN DYESTUFF REPORTER** by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

H. K. H. S. Co.—*Question*: We are enclosing herewith sample of dyestuff and will be greatly obliged if you will give us the correct name thereof.

Answer: The sample which you enclose is Chrysamine of rather poor solubility. We are sending you under separate cover 1 per cent dyeings of your sample compared with similar dyeings of a standard American Chrysamine on both cotton and silk.

S. T. Co.—*Question*: Will you please send us the best

method for bleaching absorbent cotton and knit tubing, which we use in the manufacture of sanitary napkins? The absorbent cotton is made from card strip waste and the tubing is knit from 26's single soft twist yarn. Any information you furnish us will be greatly appreciated. Under separate cover we are sending you a sample of one of our napkins.

Answer: There are various ways in which this material could be satisfactorily bleached, but in each case the preliminary treatment would be the same. The absorbent cotton could best be handled in bags of muslin or cheesecloth. The webbing could be easily handled in chain form, care being exercised to prevent tangling. We assume that the absorbent cotton and gauze are to be bleached separately.

Boil-Off.—Boil for four hours in caustic soda solution. If kier is available use 2 to 3 pounds pressure for four hours. If kier is not at hand use a wood tank fitted with steam pipes. Use 8 pounds of caustic soda for 100 gallons of boil-off liquor. Rinse well, first with hot and finishing with cold water.

SODIUM HYPOCHLORITE BLEACH BATH

Prepare a 6-degree twaddle solution with ordinary bleaching powder and water. Allow sludge to settle. Draw off clear liquor and add thereto a strong solution of soda ash until such time as all of the calcium is precipitated as calcium carbonate. This condition can be readily ascertained by filtering a small amount of solution and adding sodium carbonate (soda ash) solution. If no precipitate appears it shows that the reaction is complete. If a precipitate does appear, more soda ash must be added to the main lot. After sufficient soda ash has been added the sludge is allowed to settle and the clear solution withdrawn, placed in a vat and diluted to a strength of 1 degree twaddle. The material to be bleached is placed in this solution and allowed to remain for one-half to one hour. It is then rinsed and entered into a sour bath made up with oil of vitriol, the bath standing at 1 degree twaddle. Allow to remain for one-half hour in sour bath. Rinse well to remove last trace of acid. If not white enough repeat bleach and sour. Treat with $\frac{1}{4}$ pound of sodium bisulphite per 100 pounds of goods being bleached, diluting same to 100 gallons with water. This latter treatment destroys last traces of chlorine, which would otherwise weaken material. Rinse well in clear water.

The foregoing will yield an extremely soft bleach and will not be very expensive.

CALCIUM HYPOCHLORITE BLEACH BATH

Boil-Off.—Boil-off would be same as already outlined.

Bleach Bath.—Prepare 6-degree twaddle solution of bleaching powder and water by grinding same to a thick paste and diluting to above strength with water. Allow to settle and siphon off clear liquor and dilute to 1 degree twaddle. Enter material to be bleached and hold under surface of liquor for one-half to one hour. Wash well.

Sour.—Sour same as already outlined.

Wash.—Same as already outlined. If not white enough repeat bleach and sour. Finish in sodium bisulphite as already outlined.

This process would be the cheapest, but there would be a tendency for the goods to be somewhat harsher and less absorbent than the first recipe.

SODIUM PEROXIDE BLEACH BATH

Boil-Off.—Same as preceding outline.

Bleach Bath.—Prepare sodium peroxide bath for 100 gallons of bleach liquor as follows: $5\frac{1}{2}$ pounds oil of vitriol, 4 pounds sodium peroxide and 4 pounds sodium silicate, 42 deg. Baume. Add the oil of vitriol to 100 gallons of water (cold) and mix thoroughly. Add the sodium peroxide slowly and with constant stirring until the solution is neutral; that is, until red litmus paper will not turn blue, nor blue litmus paper turn red, when introduced into the solution. Now add the sodium silicate, diluted with a small amount of water; mix thoroughly. Enter material and raise slowly during one hour to a temperature just under a boil, and maintain at this temperature for three to four hours. Turn the goods occasionally. Rinse well and dry.

The peroxide bleach yields a wonderfully soft bleach, but would be somewhat more expensive than either of the former.

R. B. N.—*Question:* I am using an after-chromed black on wool shoddy, dyed in an open kettle. The laboratory dyeings are of good shade and fast, but the practical work always comes out reddish and will not stand fulling. How can I correct this?

Answer: In your laboratory dyeing you probably are able to dye the material evenly and chrome it uniformly so that all the black is changed into the dark and fast color, as it should be. When you work in an open kettle, poled by hand, it is not so easy to get the chrome distributed before it has acted on the black. The result is that some portions are overchromed and become rusty, while other parts, not being acted on by the chrome, still retain the red shade of the unchromed black. If you cannot install a stock-dyeing machine for this work you will have to take more time and add the chrome over a longer period of time while poling, so as to distribute it more evenly.

C. K. Co.—*Question:* In dyeing artificial silk it is generally necessary to give it a boil-off to remove oil and grease, but I find that this treatment usually results in a fuzzy condition of the fibers and a loss of strength. Can you tell me of a safe way of treating the silk to remove the oil without injuring the fibers?

Answer: The ordinary boil-off for pure silk is much too severe for artificial silk and results in split ends and weak fibers, but a treatment with about 5 per cent of sulphonated oil at 150 deg. Fahr. will generally remove every trace of oil and not injure the fibers in the slightest degree. Also, it is best not to boil too hard while dyeing, but to work at about 180 deg. Fahr.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL 7, NO. 19
NOV. 8, 1920

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

Professor Louis A. Olney discusses certain indeterminate factors with which the textile chemist has to contend in an article entitled "Modifying Influences in Textile Research"

In Part II of his article on "Water and Its Application in the Textile Industry" Walter E. Hadley discusses various methods of softening hard water, including zeolite apparatus.

L. C. Lewis, of the Wilkes-Barre Silk Co., describes a method for classifying raw silk.

The importance of the art of dyeing to the rubber industry is discussed at length by Henry J. Thompson

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 7, No. 19

NEW YORK, NOVEMBER 8, 1920

Section 2

Modifying Influences in Textile Research

Discussion of Some of the Complications Which Arise During the Investigation of Many Problems in Textile Chemistry

By LOUIS A. OLNEY

IN the consideration of any problem involving textile fibers, distinction must be recognized between results which are directly due to some specific action under consideration and those of a similar character that are due to atmospheric agencies, or indirectly due to some modifying influence which has no particular connection with the main problem. For instance, the apparent results obtained in many fiber tests, when expressed numerically, may be quite at variance with the actual figures or net result obtained when due allowance is made for certain variations which regularly occur for differences in relative humidity and temperature. This is particularly true for tests involving the tensile strength of textile material.

It might be well within the limits of possibility to report a certain textile fabric, which we will designate as A, as being stronger than another, which we will designate as B, when in reality B is the stronger of the two. Such a discrepancy could easily come about even with the use of accurate apparatus, by making one test on a day when the relative humidity was low and the other on the following day when it might be extremely high. Within certain limits an increase in moisture content, or hygroscopic moisture contained in cotton yarn, will increase its tensile strength while, with worsted yarn, the opposite is true and the tensile strength is lessened with an increase in hygroscopic moisture. As a result of these variations it is to-day an accepted fact that all such tests, to be of indisputable value, should either be made with bone-dry material or under the standard conditions of 70 degrees Fahrenheit and 65 per cent relative humidity.

In other instances results may be directly accredited to an agency which, fundamentally at least, has nothing to do with the case. The tendering of fabrics is sometimes attributed to continued exposure to a moist atmosphere, when a growth of mildew is the real cause. Retain the moisture for the same length of time, and under the same conditions, with the same fabric, but eliminate the

spores which generate the growth of mildew and no tendering will take place.

MOISTURE OFTEN BLAMED WHEN MILDEW IS REAL CAUSE

A manufacturing concern was once experiencing considerable difficulty in properly carrying out one of its processes, and finally traced the trouble to yarn which had been stored in a building previously used as a cold-storage plant. It was immediately assumed that dampness might be the chief cause of the trouble. This view was held until it was discovered that another lot of cotton yarn stored the same length of time in the same building caused no trouble whatever. A laboratory investigation of the whole subject soon located the trouble without any doubt. The paste used in making the paper cones upon which the yarn was wound in the first case was found to abound with mildew spores. Pieces of the pasteboard cone from this lot developed an abundant growth of mould when exposed to a moist atmosphere in a dark room for a few days, but pieces of cone from the second lot of yarn which had caused no trouble exposed under the same conditions showed no signs whatever of mould. It was thus shown that although the dampness of the storehouse might have aided the development of the mildew, moisture, as such, was not a direct factor in the case.

ACTION OF LIGHT SOMETIMES MISTAKEN

Even the resultant action of light upon textile material may be confused with wholly independent causes. The author once worked in a laboratory in a fire-proof building where safety had been still further augmented on the upper floor by hanging a rope fire escape at each window. As has apparently been the case in all generations, students in the way of relaxation frequently resort to some

form of side play, and this particular time it took the rather unusual form of playing with one of the fire-escape ropes. It was soon discovered that an energetic twist of this half-inch rope caused it to be readily broken in two. Examination of the rope at the next window showed that it was completely rotten and possessed practically no tensile strength. As a result the recreation which started in fooling soon developed into a serious and decidedly interesting investigation. The ropes first examined hung directly in windows where they had received the direct action of the sunlight ever since the building had been erected, a matter of ten years more or less, and it was immediately assumed that this was the cause of the deterioration. Further examination of the ropes on the other side of the laboratory that had never received any direct sunlight indicated that they were almost as completely tendered as the others. This of course immediately eliminated sunlight as a fundamental factor, and soon led to the conclusion that the long and continued action of hydrochloric acid gas, and sulphur trioxide fumes, had so modified the composition of the individual fibers, that the rope, although it retained its original form, had completely lost its strength.

EXPOSURE TO LIGHT MODIFIES STRUCTURE OF WOOL FIBER

Light, however, in some instances, is a very direct and powerful influence in the development of irregularities. Long exposure of wool to light so modifies its chemical structure that it possesses quite a different affinity for dyes, and in some instances it may in addition become seriously tendered. The garment dyer for a long time considered that the unevenness frequently resulting in the dyeing of the so-called "fades" was one of different depth of color present on the faded garment, but investigation has quite conclusively shown that this is more likely to be due to an actual chemical modification of the fiber in the faded portion which has changed its relative affinity for dyes.

This modifying action of sunlight is readily demonstrated by taking two samples of the same undyed woolen material and exposing one to the action of direct sunlight for several months, while the other is kept in the dark or exposed only to subdued light. Upon dyeing these two samples, under similar conditions, it will be almost invariably found that they take the dyestuff quite differently.

Light also exerts a decidedly modifying influence upon textile material, particularly wool, which during process becomes associated temporarily with certain chemical substances of a somewhat unstable character. The wool dyer has frequently traced streaky dyeings to the fact that woolen or worsted cloth which had been mordanted with chrome, had been exposed to direct sunlight for a time in the wet condition. The goods in this wet condition are naturally piled upon a truck or in a box, and if they happen to be left before a window in the bright sunlight for any continued period of time a decided modification of the form of the chrome mordant and possibly of the

fiber substance itself takes place along the outer edges of the exposed folds of cloth. When this cloth is subsequently dyed, a variation of shade will occur along that portion of the cloth where the exposed folds were located, and uneven streaks will result.

ACCURATE QUANTITATIVE RESULTS OFTEN IMPOSSIBLE

Among the greatest drawbacks to accurate research with the textile fibers are the modifying influences which in many instances render anything like accurate quantitative results impossible or at least unreliable within even wide limits of variation.

One might reasonably expect that if he took exactly 10 grams of well scoured worsted yarn, and dyed it in a bath containing exactly 2 per cent of an acid dye, and all the dye was extracted during the dyeing process that the skein would weigh approximately 10.2 grams when the process was completed. This, however, is seldom, if ever, the case. With other classes of dyes the variation is still greater and it is not infrequently the case that a heavily dyed skein will weigh less than its original undyed weight. Dyers of worsted yarn for the trade frequently have difficulty in returning to their patrons the same number of pounds of yarn they received. The discrepancies in this case are due chiefly to the solvent action that hot water has upon the wool substances itself and also to the fact that certain dyeing processes sometimes modify the hygroscopic character of wool fiber, so that the dyed fiber will retain a different percentage of hygroscopic moisture as compared with the undyed, even under the same atmospheric conditions of temperature and relative humidity.

With these few instances in mind, it may readily be understood how modifying influences, atmospheric, bacterial, and chemical, may obscure results and frequently render it impossible to interpret the results of textile research with the positive degree of accuracy so desired by every careful scientific worker. Textile chemistry, however, presents a broad and interesting field for scientific research, and the one who may solve even a few of its complicated problems will be rewarded with the keen satisfaction which always comes to one who has overcome many obstacles and accomplished a difficult task.

A new Massachusetts corporation, B. B. & R. Knight, Inc., is to succeed a Rhode Island corporation of the same name. The Knight Mills are among the largest makers of cotton cloth in the world, and the business is a very old one, having been established in 1846. The properties consist of seventeen mills located in Providence, Woonsocket, River Point, Arctic, Jackson, Lippett and White Rock, R. I., and Manchaug, Dodgeville and Hebronville, Mass. The mills, including the new Royal Mill, have a floor space of about 3,000,000 square feet, the equipment consisting of 533,457 spindles and 13,310 looms. The total horsepower is 26,000, of which about one-third is water-power.

Water and Its Application in the Textile Industry—Part II

Boiler Feed Waters—Removal of Scale-Forming Compounds—Softening by Lime and Soda Method—Zeolite Compounds—Removal of Iron Compounds

By WALTER E. HADLEY

THE ideal feed water for boilers would be one which contains no incrusting solids, such as Calcium and Magnesium Sulphates, and as few non-incrusting solids, such as Sodium Chloride, Sulphate, etc., as possible, in other words, as soft a water as can be obtained. Unfortunately, a soft water for boiler-feed purposes is not always at hand and, in case no adequate supply can be obtained, it becomes necessary to make use of the supply which is readily obtainable.

The danger attendant upon the indiscriminate use of any available water is that many waters contain substances such as the Sulphates and Chlorides of Calcium and Magnesium, as well as the Bicarbonates of these same metals. With the constant heating, and evaporation of the water within the boiler, the salts are concentrated and become deposited upon the boiler plates and tubes as an incrustation or sludge, and thus insulate the inner portion of the boiler, which necessitates the use of a continually increasing quantity of heat, and with it a greatly increased consumption of coal. The capacity of the boiler is thus reduced and under such conditions the boilers are overworked, and there is a constant danger of the tubes or plates giving way. It has been observed, by competent authorities, that a scale as thin as 1/30 of an inch, shows a fuel loss as high as 10 per cent, whereas a scale possessing a thickness of 1/8 of an inch shows a fuel loss as high as 20 per cent.

REMOVAL OF SCALE-FORMING COMPOUNDS FROM BOILER-FEED WATERS

There are numerous compounds upon the market for use in the removal of scale-forming compounds from boiler-feed waters. Some possess real value, if properly used, while others are worse than useless. There is no compound which can be used as a general panacea for the elimination of the objectionable compounds contained in waters used for boiler feed. The only safe and reliable method to follow is to have the water under consideration carefully analyzed by a competent chemist versed in water analysis. With the correct analysis in hand, in many cases, a satisfactory combination of corrective chemicals could be introduced into the water in question, which would satisfactorily take care of the incrusting solids. The treatment of the water should take place in proper agitating and settling tanks outside the boiler, but sometimes the corrective chemicals are introduced directly into the water and the chemical reaction takes place within the boiler itself. In the latter case the boiler should be "blown off" at frequent intervals in order

to prevent the accumulation of sludge within the tubes.

In case the incrusting solids do become baked and hardened within the tubes, the only successful way to effect their removal is to have the tubes ground out.

The writer has had varying compounds submitted for his inspection which were claimed to remove boiler-scale but up to the present time he has yet to see a compound which will satisfactorily loosen and remove boiler-scale when once firmly fixed.

Soda Ash, Caustic Soda and Sodium Phosphate are common ingredients of boiler compounds; starchy substances, and tannin compounds are sometimes used, their function being to cover the precipitate of incrusting material thus preventing the cohesion of same as a hard and compact scale.

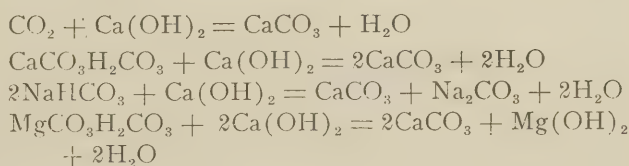
One of the main drawbacks to the use of these compounds is the need of "blowing down" the boiler to remove the sludge. Again, the presence of an excessive amount of the Sodium Salts, which are decidedly alkaline, tends to bring about "foaming," which is very objectionable.

In the use of boiler compounds it is always best to soften the water outside the boiler, and this procedure is imperative when the scale-forming compounds are high.

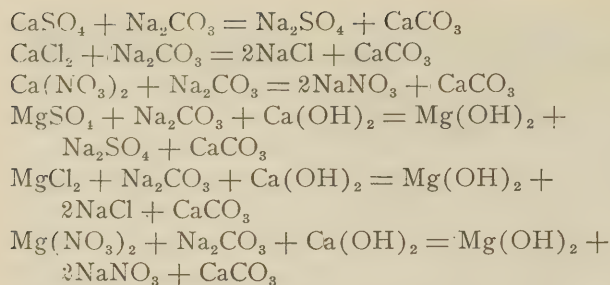
LIME AND SODA METHOD OF WATER SOFTENING

Another method of softening water for use in boilers is the well-known Lime-Soda method. This process depends upon changing the Calcium and Magnesium compounds into practically insoluble forms. The addition of Lime converts the temporary hardness, due to excess of carbon-dioxide, into Calcium Carbonate and Magnesium Hydroxide. The addition of Soda causes a precipitation, as carbonates, of the Permanent Hardness due to the Soluble Calcium and Magnesium Sulphates and Chlorides.

The reactions of the carbon-dioxide gas and the bicarbonates of Calcium and Magnesium are as follows:



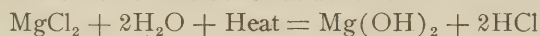
The reaction of the Soda Ash upon the ordinary incrusting solids would be in accordance with the following:



The Lime-Soda Process may be conducted in the cold or may be hastened by heating. In either case, the settling tanks must be of great enough capacity to allow a thorough settling of the precipitated substances else the insoluble portion will enter the boiler and the object of the process will be largely nullified.

One advantage of the hot process is that the air is removed from the treated water and the danger of corrosion is thus reduced.

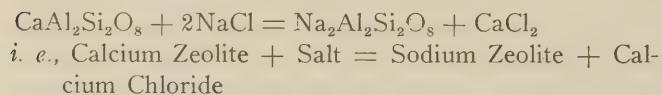
The presence of Magnesium Chloride in waters used for boiler purposes is extremely dangerous unless the waters are properly treated for its removal. If Magnesium Chloride enters the boiler, the heat causes the liberation of free Hydrochloric acid which energetically attacks the iron of the boiler as follows



WATER SOFTENING WITH ZEOLITES

Another very efficient means of water softening, and one which has come into practical use within comparatively recent years, is that which utilizes the so-called "Zeolites."

Zeolites occur as a natural formation and are in reality an Aluminum Silicate in combination with some other metallic element as Sodium, Potassium, Calcium or Magnesium, the Sodium Salt possessing the following formula, $\text{Na}_2\text{Al}_2\text{Si}_2\text{O}_8$. When the Sodium Zeolite is in contact with Calcium or Magnesium compounds in a water, it is capable of exchanging its Sodium radical for the Calcium or Magnesium radical as follows:



It is owing to this power of interchangeability, which the natural Zeolites possess, which enables plant life to take unto itself those elements which are needed for its growth with the simultaneous giving up of those elements which are not needed. Thus when a fertile soil, which has become exhausted, is treated with soluble Potassium compounds, the Calcium and Magnesium portions of the natural Zeolites are replaced with the Potassium radical. The water percolating through the earth washes away, as soluble salts, the Calcium and Magnesium displaced from the natural Zeolite, which retains the Potassium. The leaves and roots of the growing plant absorb the oxygen from the air and produce Carbon-Dioxide within the plant. This Carbon-Dioxide dis-

solves Calcium within the soil about the root of the plants, and forms Calcium Bicarbonate and this soluble Calcium compound displaces the Potassium, within the Potassium Zeolite, already produced by the application of the fertilizer, and the plant obtains the necessary apportionment of food to insure its proper development.

In a very similar manner, the Zeolites are used practically for water softening. Zeolites consist of two varieties, *i. e.*, the Natural and the Artificial. The natural, as the name implies, is found in nature and after the proper preparation, is ready for use. The artificial Zeolites are prepared by the interaction of Potassium Carbonate, Feldspar, Kaolin and Soda, certain types being prepared by a fusion method, while other types are prepared by a precipitation method. The concerns marketing these different types of Zeolites, naturally, make special claims regarding their particular product.

In general, the Zeolites when ready for introduction into the softening apparatus, are hard, coarse particles of a more or less porous nature, about the size of a coarse gravel. These granules are grayish white in color.

APPARATUS REQUIRED FOR SOFTENING WATER WITH ZEOLITES

The apparatus used for the softening of water, by means of Zeolites, is comparatively simple, consisting in general of a tank, either wood or metal, for holding the Zeolite. In addition a tank which holds the brine solution is also required.

The apparatus may consist of an open gravity type, or may be so constructed that the water is introduced into the system under pressure.

The water to be treated is introduced at the top and is distributed evenly over the apparatus. Some types have the upper layer consisting of gravel or other material resting upon a perforated steel plate which acts as a filter. The filtered water then enters into the bed of Zeolite and after percolating through same flows into an under chamber, from whence it is ready for use, or to be drawn to the proper storage tanks.

The required amount of Zeolite, necessary to soften any water, is carefully computed upon the analysis of the water in question. A series of valves are arranged in the under portion of the tank containing the Zeolite, the object of these valves being to control the flow of feed water and to facilitate the back washing, of the apparatus after the regeneration with strong brine solution.

REGENERATION OF ZEOLITE COMPOUND

After the system has softened its specified amount of water it is necessary that the Zeolite be regenerated and this is accomplished by flooding the Zeolite tank with a strong brine solution made up with a good grade of rock salt. Some types of softeners require a period of 8 to 10 hours for a proper regeneration, while in others the regeneration may be effected in one hour or less. Some claim that a reasonable percentage of the brine solution

can be saved for future regenerations while with others a fresh salt solution is used each time.

After the Zeolite has been acted upon by the salt for a sufficient length of time, the brine is drawn from the tanks and the entire system thoroughly washed to remove the Calcium and Magnesium Chloride which has been formed. The reactions which take place when hard waters, containing Calcium and Magnesium Chlorides, Sulphates, etc., act upon Zeolite are as follows:

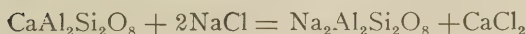


i. e., Sodium Zeolite + Calcium Sulphate = Calcium Zeolite + Sodium Sulphate

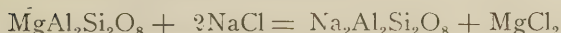


i. e., Sodium Zeolite + Magnesium Sulphate = Magnesium Zeolite + Sodium Sulphate

When the Calcium or Magnesium Zeolite is treated with common salt, the following reaction takes place:



i. e., Calcium Zeolite + Sodium Chloride = Sodium Zeolite + Calcium Chloride



i. e., Magnesium Zeolite + Sodium Chloride = Sodium Zeolite + Magnesium Chloride

Waters which contain a large quantity of temporary hardness, due to an excess of Carbon-Dioxide gas, require a special Lime treatment before the Zeolite treatment.

This special Lime treatment removes the excess of Carbon-Dioxide, precipitating same as Calcium Carbonate. This compound must be removed by filtration before the water enters the Zeolite bed.

REMOVAL OF IRON COMPOUNDS

Iron can often be removed by aeration and filtration, although there are some types of water from which the iron cannot be removed so simply. In these special cases it is possible to remove Iron and also Manganese, by means of a special Zeolite compound containing Manganese, the compound having been rendered more efficient by treatment with Potassium Permanganate. By this treatment the Iron and Manganese are oxidized and may thus be easily removed from the water.

The exhausted Zeolite compound may be efficiently reoxidized by treatment with Potassium or Calcium Permanganate.

ADVANTAGES OF WATER SOFTENING BY MEANS OF ZEOLITE COMPOUNDS

(a) Extremely hard waters may be softened so as to possess "Zero Hardness," no hardness, by passing through a properly constructed Zeolite bed.

In the Soda-Lime method it is not possible to obtain an absolutely soft water.

(b) There is no addition of correction chemicals to

be made such as is required in the Soda-Lime method where a positive control must be constantly and carefully kept.

(c) The water, after softening by Zeolite treatment, is neutral in its reaction, whereas, water softened by the Lime-Soda treatment is always alkaline, due to the excess of Sodium and Calcium Salts added to the water. The water softened by the latter treatment is not suitable for potable uses, and great care is required if same is to be used for industrial purposes.

(d) The Zeolite softeners are absolutely clean in their operation, as there is nothing added to the water.

The brine, after regenerating the exhausted Zeolite, is completely washed out and the system is again ready for the softening of the raw water.

In contradistinction to the foregoing, when waters are softened by means of soluble compounds, an excess of reagent is always required. The addition of the soluble compounds is made in order to precipitate the scale forming compounds.

The precipitate thus formed must be allowed to subside in special settling tanks, which must be of a capacity sufficient to take care of the needed supply. If the precipitation is incomplete the substances will enter the boiler and form a scale or sludge.

(e) A Zeolite softener is extremely economical of space, only a comparatively small section being required for its installation and operation.

BRIGHT COLORS IN MEN'S CLOTHING

The days when mere man was content to garb himself in suits of somber hue are passing away, and soon, writes a *Daily Chronicle* (London) representative who has been inspecting the fashions for the spring, he will be challenging womenfolk in regard to the color and variety of their raiment. Already the sartorial artists of the West End are at work designing all kinds of wonderful creations for the immaculate young man of 1921, and their efforts spell the doom of the old-time suits of monotonous blacks and grays. Bright colors—"artistic but not crude"—will be the keynote of the coming creations, the head of a well-known West End firm explained, and illustrated his point by producing a great variety of samples of the new materials in which the fashionable man about town will shortly be clothed. "Look at this one," he exclaimed, indicating a rich shade of brown. "See the beautiful blend of purple and gold in it! And here is a lovely blue—rich and pure as can be!" Checks of bold patterns, with bright streaks of color, it appears, will also be fashionable.

DISTRIBUTION OF GERMAN DYES IN FRANCE

A company with a capital of about £40,000, subscribed half by color makers and half by consumers, has been formed in France to encourage the native color producing industry and to take in hand the distribution of the German reparation dyes.

Bleaching of Cotton Knit Underwear with Peroxide

Preparation of Light-Weight and Heavy-Weight Goods for Bleaching—Scouring-Off, Bleaching, Finishing and Tinting—Analyses of a "Copyrighted" Scouring and a Bleaching Compound Show Fancy Prices

By KARL R. MOORE

Chemist, Julius Kayser & Co.

FOR the manufacture of cotton knit underwear for women's wear a 1/48 or 1/36 combed peeler cotton is used for light-weight, and a 1/24 for heavy-weights. For union goods a No. 10 cotton is used, and sometimes an artificial silk stripe of about 140 denier is run in.

In bleaching these goods for light-weights it is necessary to scour off to an absolutely clean bottom. All vegetable matter, specks, etc., must be so softened that they will disappear in bleaching. For heavy-weights which are half bleached this is not so essential. The goods must then be bleached with peroxide to a permanent white and must be after treated to promote a full handle and increased luster.

SCOURING-OFF

The goods coming from the knitting machine in roll form are first placed in a string washer and run for two hours at a temperature of between 180 deg. Fahr. and a boil in a bath containing 2 per cent to 3 per cent of the weight of the goods of tri-sodium phosphate, and 1 per cent of pure cocoanut oil soap. The cocoanut oil soap used for this and subsequent operations must be closely watched—by making frequent tests to get the iodine number of the fatty acids—for adulteration with tallow, as the presence of the latter in a scouring off or finishing soap impairs the handle of the goods, and, if used in a finishing soap, will leave a slight odor. With heavy-weight material it is necessary to add from 1/4 to 1/2 per cent of caustic to the bath in this operation, but with light-weights tri-sodium phosphate used alone gives a clean bottom without the injurious effect of caustic. After scouring off, the goods are given two hot rinses and one cold.

BLEACHING

For bleaching, a standing bath is used and the washer employed for this operation must be so constructed that no iron comes in contact with either the goods or the liquor. Two per cent of sodium peroxide or 10 to 12 per cent of Albion may be used in making up this bath. Sulphuric acid of 66 degrees Beaume is used in the proportion of five parts sulphuric to four parts of peroxide. The sulphuric acid used here should be carefully tested with sulphocyanate to see that it is free from traces of

iron, and acid should be used that is free from iron, as slight traces of it will give a pink cast to the goods. One per cent of silicate of soda is added to throw the bath on the alkaline side. (In case of the presence of wool in the material, as with union goods, ammonia is used in place of the silicate.) The goods are run in this bath from three to five hours, depending on the weight of the material to be bleached, at a temperature of 120 to 160 degrees Fahrenheit, and are matched up to standard swatches. They are then taken out and given a light rinse and scoured off, using a pint of sulphuric acid to 500 gallons of water in a warm bath and running for twenty minutes, followed by a cold rinse.

FINISHING

The bleached material is now finished off in a bath of 1 per cent of pure cocoanut oil soap and 1 per cent of a nitrated castor oil such as Alpha Bleach Oil. The object of this finishing bath is to give the full, lustrous, rounded appearance to the cotton yarn which is imparted by the cocoanut oil soap, and by allowing a little of the soap and soluble oil to remain in the goods a soft feel is produced. By using here a nitrated castor instead of a straight sulphonated castor the goods do not turn at all yellow in the subsequent heat of the drying operation, though they have a little of the oil left in them.

TINTING

After the finishing operation, the solution is run away and the washer is filled with water and 1 per cent of the nitrated castor oil and a few dippers of the cocoanut oil soap solution are added and the bleached goods are tinted to offset the very slight creamy cast left after peroxide bleaching. This is done by using a small quantity of Bleacher's Blue and Bleacher's Tint, although care must be taken, if the goods are to be exposed to sunlight, not to use a Bleacher's Blue made up of Methylene Blue, or a tint composed of Methyl Violet, for with this type of bluing a quick fading in sunlight occurs and the result is a greenish gray cast that is objectionable. Bleacher's Blues containing soluble Prussian Blue give a more permanent white fast to sunlight. The material is run in the tinting bath about twenty minutes warm, or until the blue tint shows slightly as a cast on the wet material. They are then removed and dried without rinsing.

With union goods containing wool and artificial silk after half bleaching they are given a finishing bath and tinted to a merino shade with a little Direct Scarlet and Orange, and dried without rinsing.

Several "copyrighted" scouring compounds containing mixtures of tri-sodium phosphate and bicarbonate and silicate of soda and soda ash have been placed on the market at a price about double the cost of the ingredients. One for which extravagant claims were made was analyzed by the writer and found to contain 80 per cent tri-sodium phosphate and 20 per cent bicarbonate of soda. This sold for 13 to 14 cents a pound, while the price of the tri-sodium phosphate and the bicarbonate averaged around 5 cents per pound. To the bleacher a number of bleaching compounds are offered which are recommended

to be safer to us than the straight peroxide. One for which this claim was made was analyzed and found to contain 45 per cent of sodium peroxide, 5 per cent soda ash and 50 per cent common salt. This sold for the same price as the straight peroxide. These compounds will give the same results as peroxide—only two to three times as much has to be used to accomplish the same result. Also, many of the Bleacher's Blues and Tints selling at between \$4.00 and \$5.00 per gallon are merely 2 per cent water solutions of Methylene Blue and Methyl Violet, and cost less than 50 cents a gallon to make up.

By installing a chemical laboratory or by intelligent use of a commercial laboratory, many bleacheries using large quantities of the previously mentioned compounds could make an appreciable saving as some of these compounds are used in car-load lots by large bleacheries.

Organic Research

A Discussion of a Few Phases of This Important Branch of Scientific Research

By FREDERICK S. BEATTIE

Instructor in Organic Chemistry, Lowell Textile School

In these days, the term "research" usually means organic research, since public needs point to an increased and improved output of what are known as dyes and pharmaceuticals. Pure research along any line is always justified, of course, from the standpoint of intellect and culture; but, more than this, mankind is concerned with keeping well, physically and aesthetically. We may imagine what life would be like without the medicines which we owe to pharmaceutical research. As to aesthetics really requiring color research, I wonder whether we realize how important color is in our life? We need color for our psychological health, as well as drugs for our physical well-being; and at present these two lines bulk largely in the new interest that the public, as a whole, is at last displaying in chemistry. Not altogether rightly, of course, and yet the results obtained in these two branches will furnish the touchstone by which the public is going to test the economic value of the science or rather test the extent to which we shall have made that value real. The results, then, which we shall be able to show in organic research will form the criterion for this judgment, a judgment upon which, as conditions of the past few years have shown, a large part of the continued industrial prosperity of our country must depend.

Organic research in the laboratories of our dye manufacturing plants is directed toward the improvement of known procedures for preparing dyes or their intermediates, and the working out of new procedures for dyes previously unknown. And this cannot be done by hit-or-miss experimentation, without previous clear ideas as to the probable or possible outcome. A chemist, in these days, cannot carry on organic research without having had clear and definite training in the subject: otherwise

he wastes time, effort, and valuable material, and usually fails of his purpose in addition. In the research chemist's training, the problems assigned to him may be few and simple, and at first not pointing directly, perhaps, toward results of commercial value. But he must learn *how to study* before he can decide *what to investigate*. It is *methods* that he must first acquire.

In the Organic Laboratory of the Lowell Textile School, this important fact is kept always in mind. We find that some students, when the time comes for the assignment of thesis subjects, propose to see whether they cannot work out some way of preparing a new and valuable dye. We wish that their desire were reasonable. There is nothing we should like better than to have "Lowell Textile" become known as an institution where one could always get the results that he wanted. But, in research, one must be satisfied with the *results he gets*. That is, there is absolutely no way of guaranteeing that a particular problem proposed can be solved to a particular conclusion. We lay down a problem to be studied. The work done upon it will inform us whether or not there are commercial possibilities in the further study of it. Something may come of a fact discovered in the research, or the research may bring to light the fact that nothing valuable will probably come of further work along that line. Now, each of these results has its own great value. One outcome gives us something which is of value directly. The other shows that this particular line of work is a blind alley, thereafter to be passed by. Naturally, the student is not much attracted by the possibility of his thesis bringing him only negative results, but we have to point out to him that, if he wants to be sure of positive results, he can attain this only by re-

peating someone else's work, and that obviously in this way he will never get anywhere. So he has to take up his problem with an open mind, and be satisfied with the results that he gets, whatever they are: for his thesis will be what any original work always is—an addition to our stock of knowledge in the field chosen.

During this past year, for example, an excellent piece of thesis work was carried out in this laboratory, in the phthalein group of dyes, by a member of the graduating class. The subject of the research was a study of some derivatives of fluorescein, eosine, and erythrosine, substituted more or less heavily in the phthalic acid residue. We know that fluorescein, when brominated, takes up the halogen symmetrically, two atoms of bromine entering each resorcinol ring, thus increasing the molecular weight (or complexity) without overbalancing any one region with reference to the chromophoric pyrone nucleus. Similar dyes exist in which the phthalic acid ring carries two or four chlorine atoms, without thereby departing much from the general characteristics of the simpler fluorescein derivatives. But the research in question showed that this loading of the phthalic acid ring cannot go beyond a certain point without its becoming an overload: the molecule becoming unwieldy, so to speak, through overballast in one part. It was found that the derivatives formed from a certain phenylanthracene-dicarboxylic acid as the primary nucleus were so greatly overloaded asymmetrically that they behaved, not as dyes proper any

longer, but more as indicators: or that they showed a strong tendency to remain in the benzenoid rather than in the quinonoid or colored form. Some work in this direction was begun with another more simply-substituted phthalic acid, the results pointing in the same direction: and the absorption-spectra were examined in each case. Two related lines of work have been begun this fall, and they will doubtless throw further light on this interesting and obscure subject.

Now, it is perfectly true that the research just spoken of led to the discovery of no new and valuable dye. But it has shown that this line of study will probably be barren of results from the technical standpoint, and that much is clear gain. Further, some contribution has been made to our knowledge of the facts on which the true theory of color will ultimately be based. And most of all, the student who carried out this research has learned the method and the spirit in which any investigation must be carried out, in college laboratory or in plant.

New dyes remain to be discovered—we hope that some of them may see the light in, or at least owe their beginning to, the laboratories of the Lowell Textile School. But whatever their source, they will be the result, not of a blind groping in the dark, through pointless experiments, but of patient and tireless research along definite lines previously laid down: and every fact discovered will have its part in ultimately disclosing the hiding place of the dyes that our American laboratories owe to the textile industries of our country.

Raw Silk Classification

A Practical Aid to the Dyer in the Shape of Tests for the Determination of Quality Standards Based on Evenness, Cleanness and Cohesion

By L. C. LEWIS

Wilkes-Barre Silk Company

WHEN faults appear in finished silk yarn and piece goods, it frequently happens that the dyer will be charged with poor workmanship, whereas the trouble in many cases is in the quality of the raw silk. For this reason the advantages of possessing a standard series of classifications for raw silk are obvious, since samples can then be tested and the fulfillment of individual requirements rendered certain before purchases are made. Equipped with a knowledge of the comparative quality of the raw silk as against an arbitrary standard, the dyer can be guided in his dyeing operations, and for this reason the writer herein submits an outline of the tests employed by him in determining such classifications.

The laboratory in which the tests are conducted is 30 feet wide by 50 feet long and 10½ feet high. It is equipped with two Normalair humidifiers and every endeavor is made to keep the humidity and temperature normal; namely, 70 deg. Fahr. and 65 per cent relative humidity (5.11 grains of moisture per cubic foot of air). Since the humidity directly affects the

winding test, the size test, the gauge test and the cohesion test described later, this question is one of the most important points to have settled scientifically in establishing a raw silk testing laboratory, and personal observation leads the writer to believe that it is useless to test silk without standard conditions for humidity.

WINDING, SIZE AND GAUGE TESTS

In determining a raw silk classification the writer considers three values. These are: first, evenness; second, cleanness, and, third, cohesion. The material used for the tests consists of one book from a five-bale lot, or thirty skeins taken from all parts of one bale of a five-bale lot.

The first test is the winding test. This is made by putting thirty skeins on an Atwood winder, with a Keyworth pin swift with weights. It is belt-driven and runs at a speed of 120 revolutions per minute. The test is run for ten minutes without counting the

breaks; then every break is recorded for one and one-half hours and the number per hour is recorded.

The next is the size test, which is made by using thirty bobbins from the winding test. Thirty skeins of 450 meters are reeled off and weighed very carefully on an analytical balance to 2 places.

The gauge test follows, using the thirty bobbins from the sizing test. These gauges are a set of ten, of specially hardened steel, very accurately ground and adjusted with weighted feeler blades 1/16 inch wide, graduated in deniers to conform to the diameter of raw silk as determined by Rosenzweig by specific gravity, and given in Serivalor. The gauges are shifted by means of a wheel gear and chains to conform to the average size of the silk tested, and the thread is run through at the average diameter and taken up on a flywheel to which a measuring device is attached.

Sixty thousand yards are run through the ten gauges, changing the bobbins after each ten thousand yards, calculations being based on three hundred thousand yards. As the defects appear they break the thread in trying to pass through the gauges, upon which the machine stops automatically by an electric device. These defects—such as raw knots, large knots, very large knots, waste, slugs, very large slugs, bad throws, corkscrews, split ends, loops, very large loops, nibs, fine and coarse ends—are recorded on a Denominator adding machine. The very fine ends are discovered by this test, and appear with the bad throws, long knots and other defects. They are estimated by the feel and by the way they go through the gauges, and as a final test the silk is broken on the serimeter. On a 14-denier silk, those which break at 27 grams or under are recorded as very fine ends, while if they break between 28 and 36 grams they are recorded as fine ends. The coarse ends are found by their breaking in the gauges, and are also tested on the serimeter. If they break at 75 grams or over they are recorded as coarse ends.

COHESION TESTS

The final test made is the cohesion test. This is accomplished by reeling ten threads from twenty bobbins onto four cards 6 inches long and 1½ inches wide, and having a very smooth, hard surface. This gives the experimenter 200 threads in all, and the four cards are put in the cohesion machine and the silk rolled until all the threads are opened.

The very fine ends are multiplied by 3 for a 11/16 and 17/22, and by 4 for a 22/28 denier silk. When this is added to the fine and coarse ends, the sum represents a percentage. The defects that affect the cleanness are:

Large knots × ½
Very large knots..... × 1


Waste × 1
Slugs × ½
Very large slugs..... × 1
Bad throws × 1
Corkscrews × 1/20
Loops × 1/20
Nibs × 1/20

These penalties are added together and their sum represents a percentage.

The number of strokes that are required to open the silk on the cohesion machine have a percentage value, and the cohesion per cent is added to the evenness and cleanness percentages and the sum divided by 3 for the quality per cent. Grades are designated as follows:

Double extra 95 to 92 per cent.
Extra 91 to 87 “
Best No. 1 to extra..... 86 to 82 “
Best No. 1..... 81 to 77 “
No. 1 76 to 72 “
No. 1 to No. 1½..... 71 to 66 “
No. 2 65 to 60 “

The following chart, which records the results of a test run in our laboratory, will serve to illustrate the manner in which penalties are reckoned and quality percentages arrived at:

ACCOUNT		Gomme & Minnie. DATE Oct. 19, 1920.	
CHOP Gelf. Yodasaha. Chioasagtagori, Shinshu. Japan.		STOCK: CHINA ITAL CANTON	
LOT No. 625		COLOR: WHITE IVORY ORANGE YELLOW	
BALE No. 2346		LUSTRE: VG FG F P VP	
SELLER Miteubishi & Co.		HANDS: VS SRY FG FIRM STR SPG	
MARK 			
WINDING BASED ON 30 SKEINS, 120 YDS. PER MINUTE			
BREAKS	70	CAUSE	Fine ends & gums. Gums Medium.
Defects found in 10,000 Yds. Estimated on 300,000 Yds.			
	Taken from	10 Skeins	10 Skeins
Very Fine Tlds.	3	5	1
Fine Tlds.	3	4	2
Coarse Tlds.	3	4	2
Evenness Penalties	270	300	240
Per Cent	71	69	73
	90	77	83
	210		77
Raw Knots	1	1	3
Knots Large x4	2	1	3
" V " x1	2		
Waste x1	2	2	2
Slugs x1	3	1	1
" V " x1	1	3	
Bad Throws x1	8	11	6
Corkscrews x1.20	1	1	1
Split Ends x1.20	42	36	13
Loops x1.20	13	25	17
Nibs x1.20			
	78	93	51
	57	69	63
	2005		210
Cleanness	Defects		
Per Cent			86
Tenacity	Grams 14.00	Size	Per Cent
Cohesion	1325	84	Per Cent Avg. 84
Quality	Above Per Cent divided by Threes		82
Hairiness	Very Bad Deduct 5 Per Cent	Bad 3 Per Cent	Slightly 1 Per Cent
Humidity	Dry 74	Wet 65	Relative Per Cent
			Absolute 6.90
			Grains
REMARKS	Weight of 30 skeins 4.7 lbs. from the U.S.T.Co.		

Dyeing and Its Connection with the Rubber Industry

Rapid Expansion of the Rubber Industry—Consequent Demand for More Colored Effects—Difficulties Which the Dyer of Rubber Fabrics Must Face—Full Knowledge of Processes Necessary in Selecting Dyes—Colors Particularly Suitable for Use in This Work

By HENRY J. THOMPSON

ALTHOUGH the dyeing and rubber industries have been closely associated for years, particularly in the manufacture of our footwear, few people ever give a thought to the real importance of the relationship. It is a fact, however, that these two industries are associated by the same ties which bind together the dyehouse and the manufacture of colored fabrics in cotton, wool and silk.

The fabrics used in the manufacture of rubber products are dyed for the selfsame reason that encouraged the makers of fabrics for garments and many other purposes to resort to the dyeing of their goods; namely, to make them more attractive to the tastes of the purchasing public. When we consider the fact that it is the textile fabrics used in the making of the rubber goods that claim the attention of the dyer, and that these same fabrics are the products of cotton and woolen mills, we can readily understand that the methods of dyeing for the rubber people must bear close relationship to the methods of dyeing for the textile industry. This is true, for the well-known methods used for the piece dyeing of textile fabrics are used by the dyer of rubber fabrics.

FULL INFORMATION FOR DYER ESSENTIAL

The important consideration that the rubber fabric dyer must keep foremost in mind is the one that is peculiar to the rubber industry; i. e., vulcanization. The materials and conditions necessary to vulcanize the rubber are not always recognized by the dyeing experts as essential considerations in the production of dyed rubber fabrics which are always expected to show up in the finished product in clear, full tones. This is possible of accomplishment, nevertheless, and it is being accomplished by the rubber fabric dyer every day. Of course, it is hardly necessary to mention the necessity of the dyehouses handling these fabrics understanding the conditions to which their colors are to be subjected.

The conditions vary to a great extent. The rubber man takes it for granted that he can use the dyed fabric without fear or favor; this places all of the responsibility upon the dyer. As vulcanizing is performed after the goods are made up, it being one of the last operations previous to packing in cases for

shipment, we can understand how necessary it is to achieve dyeings about which there can be no doubts. Dyeing that will not stand the operation of vulcanizing cause a big loss, due to the goods being rated as "seconds," etc.; and as many of the rubber mills run production on a large scale, the difference between "perfects" and "seconds" soon mounts to huge monetary proportions.

The rubber manufacturer orders his dyed fabrics in any amount that he thinks proper, and we will take for an average 100,000 yards of a certain shade. The fabric is for the footwear or clothing trade, hence the necessity of cutting it up into insoles, for stock, counters, vamps, collars, etc. From the process of coating through the cutting, making, varnishing and vulcanizing operations, immense quantities are on the move which cannot be turned back, as they are in a condition that renders them impossible to redye in any way. They are, after the first gum is applied, started through the series of operations which ends in the vulcanizing heaters and which must continue to these heaters without interruption, there being no alternative. When once on the move, our 100,000 yards become very valuable after all the necessary operations to which they are put through. Hence the rubber fabric dyer is under great obligations to the rubber manufacturer; he either must furnish dyeings that will stand all conditions, or he must understand just what conditions the different fabrics are required to stand, and select dyes accordingly.

This latter understanding is the best, as it enables him to use the different classes of dyes to their best advantage, both from the standpoint of sufficient fastness where required and economy in using colors not required to be so fast in other cases.

VAST INCREASE IN THE USE OF RUBBER GOODS

The rubber industries of the United States and Canada are in the control of live, progressive men; consequently this industry is rapidly expanding, both in volume and variety of products, and carried along on the wave of this expansion is the increased demand for dyed fabrics, so that to-day the dyeing industry is a very essential part of three important branches of

the rubber products output; namely, clothing, footwear and automobile cloth. The demands for automobile cloth have developed to immense proportions, and fast shades not only to vulcanizing but also to sunlight and weather are required of these dyeings. The footwear products demand the greatest variety of dyeing, and the most severe vulcanizing tests are experienced in this line. The clothing trade demands a variety of fast and fancy shades.

In fabricated rubber goods, the fabric being generally the foundation upon which the product is constructed, it is an absolute demand of the rubber people that the dyeings must not impair the strength of the fabric, and, further, that the dyeings must be absolutely clean and free from any chemicals that may develop during the vulcanizing into compounds that would weaken the fabric or attack it to any degree. This is absolutely imperative, for when the fabric is attacked the goods are a complete loss. The rubber manufacturer calls for a large variety of fabrics, each fabric having its special function, but strength is paramount.

WHY ABSOLUTELY EVEN DYEINGS ARE NECESSARY

Variation of shade, even to a slight degree, is a troublesome condition against which the manufacturer of fabric-top rubber footwear registers a protest. Counters, vamps and tongues must match and, as they often are cut from different lots, good duplicate dyeings must continue. The cutter will cut a large number of vamps, after which he will cut counters from different dyeings or pieces; these are eventually sewed together to make a shoe, and a variation of shade will show, the vamp being somewhat different from the counter. The use of tire fabric and enameling ducks for fabric-top footwear has given rise to a demand from the rubber man for good penetration of the dyeings on these fabrics.

In the making of these goods the fabric is turned in on the top edge and on the edge near the lace-holes. If good penetration of the cloth is not obtained, the dyed cloth will show light spots between the threads, and this is especially emphasized when tire fabrics are used, these being a very heavy, coarse cloth.

In years gone by rubber goods were looked upon as mostly wet-weather necessities, but to-day the rubber goods manufacturer is an absolute necessity 365 days in the year. This all-the-year-round demand for his products has settled his business on the firm foundation of an essential industry, and has led to extensive organizations always ready to please the public as to durability, style and appearance of the goods.

The dyeing of the fabrics is completed before any rubber or gums are applied, and the standard methods of dyeing are used. Tire fabrics, enameline ducks, fine rubber ducks, twills, narrow and broad 'drills, sheetings and Osnaburgs, cotton flannels, jeans, sa- teens, wide cotton tubular fabrics of all styles, merino

nets, all-wool jersey cloths, cotton-back wool-fleece nets, cashmerettes, etc., constitute the bulk of the fabrics used.

PRINCIPAL TYPES OF COLORS EMPLOYED

Sulfur dyes, direct cotton colors, developed colors, acid dyes, natural and mineral dyes—all have their uses; and it is in their proper choice and application that the dyer exercises his judgment. Sulfur and mineral colors on cotton for Blacks, Browns, Buffs and Olive Drabs change some in vulcanizing, but may be satisfactorily used. Cutch and Fustic are good, as they penetrate well and hold their color. The Iron Logwood Black can be used for linings; but the so-called Ash Black, while being all right for "forn stock," will not stand the rubber compound on insole stock, and neither is used for fabric-top footwear. Aniline Salt Black has given way to Sulfur Black; the former stood the vulcanizing well, but the fabric was likely to come out of the heaters in a weakened condition. Aldehyde colors subsequently treated with aldehyde and chrome have produced satisfactory colors for footwear and clothing, as have also the developed colors. Substantive colors can be used in certain places, but the dyer must know in what part of the product they are to be used and only the best grade of clean, soluble dyes are to be considered. For blacks on cashmerettes Logwood is used, and is found to stand the vulcanizing on this type of woolen goods.

PROCESSES THE COLORS MUST WITHSTAND

The fabric, dyed and clean, is stored in a hot chamber to keep it free from moisture and in the right condition for taking the compound. The dyed fabrics and rubber compounds or gum, as the case may be, first meet at the calender. These calenders are both large and small; the larger ones are big affairs, with three heavy steel rolls that are heated by steam and apply the compound to the fabric under tons of pressure. In the manufacture of automobile cloth, after being coated the fabric passes along to be varnished or finished on the rubber side, and is then passed along to the vulcanizers. In the production of other products different methods are used; in certain cases, as in the upper part of rubber shoes, the cloth is coated in the calender with gum compound and the rubber is applied to this gum later on. Whatever method is used, vulcanization must take place; and as the rubber grinder uses many different compounds to coat his dyed fabrics, it is here that the effect on the color takes place. The sulfur, lead, etc., used in the rubber compounds are heated in closed chambers until chemical reaction with the rubber takes place. In some articles it is more severe than in others, and in some products the same dyed fabric will have different compounds; hence the color must be fast to all these varying conditions.

Notes on the Dyeing of Mixed Goods of Wool and Cotton

Determining Relative Percentages of Fibers—Preliminary Experiments—Classification of Colors—Methods of Retarding and Accelerating Dyeing Action—Necessary Equipment

By GILES LOW

Newport Chemical Works, Inc.

THE production of fabrics of mixed wool and cotton has constantly been increasing within the last few years, and now a large percentage of the cloth on the market is found to be unions of this nature. Unfortunately, there are cases where this has been done for the purpose of defrauding, but it is usually a genuine attempt to produce better looking fabrics at lower prices. Whichever the case, the dyer's problem is the same—he must cover up inferiority.

A few suggestions regarding the dyeing of these fabrics may not be out of place here, and may prove of value to those who are just taking up this interesting branch of dyeing and have not yet found out how much there is to be learned before continuous success can be assured. Dyeing these fabrics has strained the ingenuity of our dyers and our manufacturing color chemists, and the textile expert has spent many days locked in his laboratory studying over the problems involved.

RELATIVE PERCENTAGES OF FIBERS

Of primary importance is the weave of the fabric which is to be dyed; that is, whether both fibers are in evidence or whether one serves only as the background for the other. On this depends just how close a match is necessary. Also, the proportion of one fiber to the other must be taken into consideration, because the same result will not be obtained by the same process on a cloth which is 75 per cent cotton as will be on another piece which is only 25 per cent. It is therefore advisable wherever possible to use a piece of the material which is to be dyed for all experiments and to know exactly what the percentage of each fiber is, in case notes are made for future reference. The percentage in a piece of union goods may be easily ascertained by boiling a swatch of the goods of known weight—say, for example, a piece weighing 5 grams—in a bath containing 300 c.c. of water and 10 c.c. of caustic soda solution (60 deg. Tw.). The wool will be dissolved and the cotton may be removed, washed and dried and its weight compared with that of the original piece.

CHOICE OF DYESTUFF

Of course, the desired color is the controlling factor in the selection of the dyestuff, but the characteristics of the products which produce suitable shades

so modify their selection that they almost supersede in importance, and the choice of shade really depends upon the dyes available with characteristics which meet the requirements.

Most of the dye manufacturers or dealers either publish or will supply information regarding the properties of their products in this regard, but the dyer who has a laboratory at his disposal will find infinite satisfaction in investigating the colors for himself. He will usually find products and operations suited to his own needs which have not been discovered elsewhere or are not of enough general interest to warrant publication.

PRELIMINARY EXPERIMENTS

A piece of the material to be dyed is the best thing to use for laboratory investigation, as there is likely to be a difference in the degree of the pretreatments of the fibers, such as mercerization, etc., which would definitely affect the properties of absorption. Also, there is no more satisfactory way of representing the proportion of the two fibers than the use of a piece of the actual material. The pieces should be cut to a weight representative of the batch to be dyed, and miniature bath should likewise correspond to that which will be used in the dyehouse. It should be twenty to twenty-five times the weight of the material to be dyed. Prepare the bath with 20 per cent of Glauber's salt. Enter the well-wet-out goods and work cold for twenty minutes. Bring bath to a boil and boil for twenty minutes, and then allow the goods to remain in the cooling bath for twenty minutes.

CLASSIFYING COLORS

The result will show something definite about the color, and with a little experience one can tell from this little dyeing exactly how the batch should be run. The dyes are then classified as follows:

Class No. 1 dyes cotton and wool practically the same shade. Notable among this class are the Benzo Purpurines, Congo Reds, Garnets, Pink 2B, Orange R, Chrysamine, Chrysophenine, practically all direct greens, Fast Blue RW, Brown GXR, and the majority of the direct blacks.

Class No. 2 dyes cotton deeper than the wool. To this class belong Fast Red F, the Stilbene Yellows, Fast Yellow NN, all the Sky Blues, Blue 2B and 3B, Violet N and R.

Class No. 3 dyes wool deeper than the cotton.

Class No. 4 dyes the two fibers differently.

These latter two are not very desirable circumstances, and fortunately not many products will be found in these classes.

Frequently two products will be found, one from Class 2 and one from Class 3, which by mixing in certain proportions will produce a good union.

During the time that the bath is below the boil the color is apt to feed on to the cotton, while in the boiling bath the wool is usually being favored; so, by cutting down on one period and lengthening the other, equalization will often be effected.

ACIDITY OR ALKALINITY OF BATH

Another stringent controlling factor is the condition of the bath regarding acidity or alkalinity. An alkali retards the dyeing of the wool and frequently accelerates the dyeing of the cotton, while an acid acts in a directly opposite manner. Should the wool be dyed too heavily the addition of an alkali to the bath will serve to correct it. A mild alkali should be selected, such as alkaline sodium phosphate or borax, and in some cases a small amount of soda ash or ammonia may be employed.

If it is the cotton which is dyed too heavily, the correction is comparatively simple. The quality of the dyestuff to act in this way is therefore decidedly advantageous. Lengthening the boiling time and cutting down the other, or even dispensing with it altogether, is the simplest. A little acid will often turn the trick, but with some colors the result may be dull. Acetic or formic acid serve the purpose, as they are less severe in their action on the coloring matter and on the cotton than the inorganic acids. Simply lengthening the bath may also produce the desired result. Wool will continue to dye from very dilute baths, while cotton requires considerable concentration.

Acid colors should next be examined and a list made of those which will dye wool in neutral baths, leaving cotton unstained. Notable wool colors of this class are Rocceline, Chrome Red A4B, Azo Eosine G, Metanil Yellows, Naphthol Yellow S, Acid Blue R, Cyanone R, Acid Violets 6R, 5B and 10B, and Chrome Orange GG. Others which may be used for light and medium shading are Bordeaux, Phloxine, Tartrazine, Orange II, Violet 4BS and Wool Black B.

With a little experimenting suitable mixtures of these with Class 2 colors will be found, so that very easy dyeing methods may be used. The so-called "union colors" which are put out by the various dyestuff firms are mixtures of this kind.

THE TWO-BATH METHOD

If the desired shade cannot be produced by this method the two-bath process must be resorted to.

This consists of dyeing the wool first in an acidified bath and then bringing the cotton up to shade in a bath below the boil; or, for the darker shades, such as brown, navy and black, the process may be reversed, as it may also be when the cotton has been dyed with colors which are fast to acid cross-dyeing. This method places practically all of the acid colors at the disposal of the dyer, and this method is also employed for two-color work.

After a dyer has spent a little time on such laboratory experimenting as this he can go into his dye-house with a more secure feeling about entering a great many yards of goods, at a corresponding number of dollars, into a dyetub.

Of course, the results are going to differ slightly from those obtained in the laboratory; but, on the whole, the process and action of the color will be so similar that he can be sure of himself and not be absolutely lost in the woods, as it were.

IN THE DYEHOUSE

Either a jigger or a vat equipped with a winch may be used, depending on the pattern of the piece. No special heating arrangements are necessary. Closed steam coils, however, are always advisable. Also, it is well to use open boxes so that the progress of the dyeing may be observed from time to time. It should be remembered, in inspecting the dyeing, that colored cotton will always look much darker wet than dry, and therefore should, at the completion of the dyeing, appear to be about double the intensity of the wool.

For yarns, etc., the regular rectangular vat is used.

The dyer should inspect his material before dyeing and insist on proper scouring, as it is frequently noticed that the cotton is not as thoroughly wet out in these materials as it should be, owing to the fact that when the wool is sufficiently scoured the piece has the appearance of being ready, although the cotton may still be only half soaked out.

VALUE OF SOFTENING OILS

The use of mineral oil preparations in the textile industry is steadily increasing in all lines. The objections to mineral oils are due either to odor or to the resistance to saponification and emulsification. The points in their favor are low cost, lubrication, brightening power and freedom from chemical action on the fibers. There are ways of removing both odor and color, and, we learn from the *Textile World Journal*, that lately means have been devised to form permanent emulsions which will rinse out easily if not allowed to dry. If these conditions have been met there is no reason why the softening, lubricating and brightening effect, coupled with the lower cost, would not give satisfactory results in comparison with oils which are likely to become rancid, and not only produce odors but actually tender the fibers.

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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THIS SECTION TO BE PUBLISHED EARLIER IN THE MONTH

Heretofore it has been the practice of the publishers to bring out the Monthly Technical Section of the AMERICAN DYESTUFF REPORTER in conjunction with the second weekly issue of each month. It has now been decided to move the publication date forward one week so as to mail this section with the first issue of each month, and this policy will take effect with the next issue. This will be dated December 6 instead of December 13, while subsequent issues will be published on January 3, February 7, and so on.

SECESSION OR UNION?

Repetition can be a most boresome thing, but it has its uses, too, and rightly employed it is one of the most certain and forceful of means for driving home an important truth which may have to compete for attention with the multitudinous activities and considerations of a busy life. Thus it is that while there yet remain some who either negligently or wilfully ignore its significance to their own future welfare, there cannot be too much repetition of the fact that in less than a month the chief law-making body of our Government will resume activities, with the Dye bill in line for consideration at any time.

Because nobody knows just when that time will be, it is all the more necessary to again bring up the subject here and now.

It will not be an outwardly changed Senate which will sit down to its renewed deliberations, but, unless all portents are undependable, the change within should become speedily apparent. The effect of the election is likely to be both settling and unsettling upon the members of that body. As matters stand, it is known that there are enough favoring votes—unless several changes of heart have been experienced—to pass the bill if it is voted upon before the

present Congress ends its session to make way for the new one. With all the pre-election questions of policy now safely out of the way and the final results unalterably fixed, there ought now to be nothing further to hinder our Solons from giving the Dye bill unprejudiced attention. That is what has been the hope of the dye manufacturers and the great majority of the consumers who realize the importance of the proposed measure. Yet, if by any chance this Congress leaves the bill to be disposed of by the next, we shall then find that conditions have changed somewhat, with the possibility existing that some of the preparatory work will have to be done over again. The Republicans have gained a firmer grip on the control of the Senate, and while at first blush this would indicate better chances for passing the bill as it stands because of Republican principles as regards protection, there is also a chance that they may discard the licensing scheme, which is no part of their creed, in favor of a straight high-tariff bill. It must be remembered that Democrats are normally favorable to free trade to the greatest extent possible, yet many Democrats both in House and Senate supported the Dye bill because they were rightly persuaded that it was a question having nothing whatever in common with any ordinary tariff question. Paradoxically, therefore, it is possible that the Democrats may regard a licensing scheme as less of a departure from their beliefs than even the protectionist Republicans, and that the latter, feeling a renewed confidence in their ability to do about as they please and no longer deterred from doing what is right by reason of party consciousness, might, then, wish to further show their independence by going about protecting the industry in the way they have been brought up to believe is the only way to protect an industry—which, in the case of the dye industry, will not answer.

That means you must be ready to point out, quickly and decisively, that it is the will of a great majority of those interested that the licensing principle be adhered to in one form or another.

If the dye industry does not receive protection in the form of an import licensing law, preferably administered by the Tariff Commission because of its experience and impartiality, the first people to suffer, naturally, will be the dye manufacturers. That fact does not appear to have much significance for a remnant of the textile industries, nor will it have until they are brought to realize that the next persons to suffer will be themselves. After them will come the public at large.

In the case of the public, the first hint of trouble would appear in the information that American dye manufacturers, in whom all were rapidly coming to believe, were beginning to lose ground instead of progressing as formerly. After that there would be reports, gradually forced upon their attention by Government investigators and others, that America was not keeping abreast of the times in the production of new and important medicinal chemicals, and that American research workers were dwindling in numbers and barren of accomplishment. And finally someone would publish an article proving

conclusively that America was in a state of disgraceful unpreparedness for possible war. In other words, the entire country, including the dye consumer opposing adequate protection for the dye industry, would be a loser along with the dye manufacturer. If this truth were but universally recognized by color users, the last vestige of opposition would vanish.

But no; there are some textile manufacturers who still fail to see that the fight of the American dye manufacturers for complete independence is *their* fight for complete independence, not in the matter of coloring materials alone but for their general welfare—their very safety. They fail to grasp the significance of their role as a part, not the whole, of a vast system of interlocking industries and endeavors mutually dependent upon one another for continued success. They fail to see further ahead than next year, and they fail to understand that whatever handicaps the dye industry, sooner or later handicaps themselves and after them the entire country. They display the reasoning of a man who pushes the keystone from an arch because he does not like its design, and then wonders why the whole structure collapses.

At the recent meeting of the Southern Textile Association, Edward H. Marble, of Worcester, Mass., representing the National Association of Cotton Manufacturers, told those present that the solution of the problems of men engaged in all lines of the textile industry is found in the single word "co-operation," and in the application of the Golden Rule. "It is an old rule," he said. "a tried rule and, best of all, a workable rule. With it the cotton industries can be placed on the firmest possible foundation, and a harmonious and beautiful structure erected thereon that will be a delight to all, whether they represent the staple, the yarn, the product of the loom, the mechanical or chemical equipment or the finances necessary for the proposition."

To those remaining "irreconcilables" of the textile industries, therefore, let it be said: The bulk of your colleagues, having reasoned the matter out, are in favor of protecting the American dye industry until it no longer needs protection. In the struggle of the dye industry to galvanize a slothful Senate into action, it is not your place to be merely a spectator. It is an easy matter to write a brief letter to your Senator explaining that you want the industry protected; a single paragraph or even a single sentence is all that is necessary and, indeed, would be vastly preferable to a lengthy exposition of your reasons. Delay hurts both the dye manufacturers and you, and if every last individual in both industries will drop a line to Washington between now and December 6, when the Senate again convenes, the issue might be regarded as settled. Let's get it out of the way, once and for all.

Through the ages the worth of intelligent co-operation has so impressed itself upon mankind that the idea has found its way into a multitude of expressions and sayings, all having the same end in view. So, whether you select Emerson's "All are needed by each one," Peter's "Be ye all of one mind," the Three Musketeers' "All for

one and one for all," Morris's "United we stand, divided we fall," or, best, the motto of the United States, "*E Pluribus Unum*"—"Out of Many, One," you may be sure it will pay you to keep the idea in mind, not only until after the Dye bill has been passed, but as long as you are in business.

The last-mentioned motto could not be improved upon, since the nation of States depends upon the success of a nation of industries within its borders. The North went to war with the South because, in the words of Abraham Lincoln, "We loved the South and did not want her to leave us." For the same reason you should not hesitate to do battle with anyone planning to secede from the great union of industries, serious damage to any one of which, in the end, is felt by all the others.

AMERICAN DYES AND THE COMING SILK EXPOSITION

Those allied with any of the textile industries should receive with approbation the news that plans for the International Silk Exposition, to be held in Grand Central Palace, New York City, during the week of February 7 to 12, are progressing favorably. It is the intention of the board of managers of the Silk Association of America and the board of governors of the Silk Travelers' Association to conduct the affair on a huge scale, and to ask the assistance of trade journals, newspapers and fashion journals, and of wholesale and retail stores throughout the United States, in making a special feature of "Silk Week." The interest which such a movement is certain to arouse on the part of the public will be widespread and genuine, and the opportunities for advancing the prestige enjoyed by our textile manufacturers generally will be ample.

Since the plans for the affair are elaborate and it is proposed to outdo previous efforts in the way of staging the exhibits, it might be well for those who can do so to attend, whether they happen to be connected with the silk industry or not. Moral support plays an important part in the success of any kind of an undertaking, while the educational features should be valuable to those engaged in allied lines, although intended primarily for the enlightenment of the trade and the public.

Dyers and dye manufacturers particularly should find plenty to interest them, for the goods displayed are certain to include the very latest word in delicate shades and novel effects. It is here that the dye industry, too, can logically expect to gain some additional and extremely favorable publicity with the public, if the executive committee in charge of the Exposition can be prevailed upon to co-operate.

By this we do not mean that the dyeing part of the preparation of the fabrics should be emphasized at the expense of the fabrics themselves. The Exposition is not to be a chemical exposition, and one would not expect to see labels indicating that "This Material Was Dyed with Rhodamine B Extra"—which would

mean as little to the public as anything well could, and would furthermore detract from the spontaneous charm of the exhibits.

But since dyeing is an essential part of the production of beautiful silk goods, the attention of the technical visitors might at least be called in some way to the ability of certain fabrics to take their colors evenly, while a few signs in various parts of the building impressing the thought that American colors were responsible for the rich, vivid and harmonious shades could do no possible harm, nor would they bore visitors, while they would indeed be aiding a valuable cause in strengthening public confidence in the future of our own color producers.

It is to be hoped that some such suggestions will be made to the committee in charge, and that action will result.

EYESTRAIN AND PHYSICAL FATIGUE

Employers or others engaged in the management of our textile mills will do well to interest themselves in the campaign which is now being conducted to educate factory heads in the importance of eyestrain as a retarding factor in production, and to eliminate this handicap as far as possible. When figures show that out of four hundred employees of one Massachusetts concern, three hundred and twenty-four were suffering from eyestrain, and that headaches and other troubles were common among those engaged in the closer types of eye work; and when it is shown that a twenty-eight per cent increase in the output was brought about by a correction of conditions which produced defective eyesight, it goes without saying that the subject is worthy of attention and study.

The menace of infected teeth is now generally recognized, and most forward-looking employers have taken decided steps to have employees inspected and troubles remedied. The average examination, however, often fails to reveal defective vision, particularly latent shortcomings which may develop, often without the knowledge of the sufferer, if light conditions are not right and the work is fine. The fact that the relation between eyestrain and simple physical fatigue is direct is not realized by one in a hundred employers of labor as yet; nevertheless, the latest theory of medical men is that no less than one-third of the human system's nervous energy is allowed to the eyes and expended through those channels when one undertakes to use these organs continuously for eight or ten hours at a stretch.

There is no good reason for here introducing a protracted discussion of the relationship. Recent investigations have proved it to exist and have proved that the average standardized medical examination for employees does not take cognizance of it. Common humanity would dictate the addition to the regular staff of examiners of an oculist who has full knowledge of

the light conditions under which all employees work, while the potent factor of increased production should remove all hesitation from the minds of those who would hold back from an investigation because of its comparatively insignificant cost.

DYEING RAW SILK

A process has recently been patented for dyeing single-thread raw silk in the skein. The gum is kept from dissolving until after the dyeing process is completed. The silk is given a sulphuric or hydrochloric acid bath, the temperature depending on the color desired.

The silk is then subjected to the action of a solution of alum, chrome acetate, of chrome chloride, of nitrate of iron, or any iron-liquor used in dyeing, depending upon the color used in dyeing. The action of these mordanting agents is to harden the gum, producing an insulation around each thread which protects the hardened gum on the threads against the action of the alkali or acid present in the dyeing solution.

The threads which have been treated will be pliable but firm, and can be worked for a considerable length of time in the dyeing solution without affecting the ceraceous matter in the gum present in the silk.

After this operation has been completed, the silk may be dyed in the usual manner. The dye employed must have an affinity for the particular hardening fluid or preservative employed to produce the insulation.

When the raw silk has been dried after the dyeing operation it will be ready for weaving. After the weaving operation has been performed, the fabric is boiled in a strong solution of soap and water, which will eliminate the gum or ceraceous matter and bring out the color and luster.

The gum in the raw silk is thus preserved until after the dyeing and weaving operations, its removal being the final operation. The retention of the gum results in keeping each thread apart, and hence they can be readily separated when they are to be woven or thrown. The dyeing operation is not hampered by the presence of the gum, as the dye will penetrate the gum but will not soften or dissolve it, owing to the hardening process described. The dye will penetrate and pass through the gum.

One of the advantages of the process is that the threads comprising a hank of silk can be treated in untwisted condition in hanks or warps, the natural gum being preserved or hardened in each thread composing the hank, thus enabling the storage of the hanks for dyeing at a future time. Silk threads can be preserved for a considerable length of time by subjecting them to the hardening process. The dyeing operation does not necessarily have immediately to follow the hardening or insulation of the gum in or on the silk threads.—*Dyer & Calico Printer.*

STANDARD DYESTUFF TESTS

In verbal discussion with representative dyestuff consumers the REPORTER finds that very considerable interest in the proposition to establish a central bureau wherein dyestuff tests shall be made and recorded by standard methods has been aroused. We reproduce herewith a communication on this subject from Wm. D. Livermore, and shall welcome expressions from any who are interested. Mr. Livermore's communication follows:

"I have read the plea of Professor Olney for standard dye tests in the AMERICAN DYESTUFF REPORTER of September. This plea seems particularly calculated to help the Textile manufacturer who does not systematically test all the colors on the market for their suitability for his own specific uses.

"It would therefore be important to have sufficient interest in this form of standardization on the part of consumers in general to make it attractive to color manufacturers to describe or offer their products in terms of this standardization.

"Moreover the work would have to be done with the utmost care and accuracy, and with the greatest degree of co-operation between textile manufacturer and the color producer, or it would result in disagreeable controversy or worse. A very few errors would discredit the entire effort with those that it is intended to help.

"It should also be confined generally to what might be called commercially pure dyestuffs, and could not reasonably be extended to the innumerable combinations and special brands made up to fill local and passing demands.

"The writer does not believe that it would be difficult to formulate a system of test methods as this work has already been well done and described in years past by some of the larger color manufacturers. What is lacking, however, is a satisfactory and generally acceptable basis for the interpretation of these tests and this is essential to give them practical value. Colors are not absolutely fast or absolutely fugitive, but only comparatively so. I am unable to think of any such basis outside of direct comparison of tests of the color under consideration with identical tests made on selected well-known colors, chosen because of their adaptability in forming a scale of fastness in some one characteristic, i. e., fastness to light, or fastness to fulling, etc.

"This matter of a satisfactory scale will present real difficulties but there is no reason to doubt that they could be overcome.

"If sufficient interest were aroused it would seem quite within the province of the various associations of the textile manufacturers and color producers to appoint a joint committee to consider the problem and, if thought desirable, delegate the task of solution to a group of competent chemists. The result of this work should prove of great value to both the manufacturer and consumer of colors."

WM. D. LIVERMORE.

Review of Recent Literature

"Health Hazards of the Dye Industry." A. K. Smith, Medical Director of E. I. du Pont de Nemours & Co., 10, p. 255 (1920) *American Journal of Public Health*. Mention is made of materials injurious to health including concentrated nitric and sulphuric acids, and mixtures of the two acids, nitrous fumes, and products formed by the action of the mixed acids on members of the benzene series, which poison by inhalation or absorption through the skin. It is not always possible to trace a case of poisoning to a particular substance, but dinitrobenzene, o- and p-toluidine, the diamines, phenylglycine ground with aniline, magenta and rosaniline colors have poisoned workmen more frequently than other products in that factory. In the case of some employees personal idiosyncrasy is very marked, and such men should not be allowed to come in contact with poisons. The hazards of the color industry are no greater than those of other industries, provided the buildings are properly equipped and ventilated, that the workmen are carefully selected, and adequate medical supervision is provided.

"Technical Education in Germany." *Chem. Zeitung*, June 17, 1920. The number of students in the various Technical Colleges in Germany is now 18,686, compared with 12,200 before the war. Of the total 3,333 are chemical, biological, or pharmaceutical students, the corresponding pre-war figure being 1,544.

German Color Calendar; 4 by 6 inches; 164 pages; A. Ziemsen Verlag, Wittenberg, Germany. Text in German. Price \$2.00.

This volume is a calendar for 1920 especially designed for the users of colors. It has blank spaces for daily notations and, in addition, contains a great variety of interesting information of a technical and historical character. The list of subjects, which is too long to be reproduced here, includes the following: Chronological table of events in the history of German coal-tar dyestuffs from 1901 to 1914; Substitutes for Textile Materials; The Cleansing Trade in War Time; Cost Finding for the Drying Process; Tests in the Silk Weighting Process; Illustrated Historical Sketch of Dyeing; Classified List of Dyestuffs.

"The Determination of Bleaching Properties of Materials." P. Klemm. *Chem. Zeitung* 44, p. 458 (1920) Description of simple tests which in the hands of an experienced practical man suffice for industrial purposes.

"Chemical Reactions During the Treatment of Pulp in Hollander." C. G. Schwalbe. *Chem. Zeitung* 44, p. 458 (1920). Contrary to prevailing view fibers are chemically altered during their treatment in the hollander, changes taking place are fully discussed.

MEN OF MARK IN

DR. CHARLES L. REESE was born in Baltimore, Md., November 4, 1862. He was graduated from the University of Virginia in 1884. After graduation there he studied abroad at Heidelberg, under Bunsen, and at Göttingen, under Victor Meyer. At Heidelberg he received his doctor's degree. On returning to this country he was appointed assistant in chemistry at Johns Hopkins University, which position he held for two years, from 1886 to 1888. He then became professor of chemistry at Wake Forest College, after which he was appointed to the same position at the South Carolina Military Academy, Charleston, S. C., which position he held for eight years. While there he published a very important paper on the "Origin of Carolina Phosphates," in which he was the first to develop the theory of their formation which is now universally held.

Following this residence in Charleston he became instructor in chemistry at Johns Hopkins University, which position he held for four years, and where he published important papers in *Berichte* and the *American Chemical Journal*, in conjunction with Professor H. N. Morse, on the "Oxides of Manganese."

Up to the time Dr. Reese left Johns Hopkins University, in 1900, his career had been similar to that of hundreds of other chemists in this country who devote their lives to teaching and research, and that date can be said to mark a definite turning-point in his life, for it was then that he started on his technical career, which has led to such brilliant results.

He started in this work as chief chemist for the New Jersey Zinc Company. At this time the contact process for sulphuric acid was in its infancy. As chief chemist for the New Jersey Zinc Company he developed this process until it was on a satisfactory working basis, and his work there was the pioneer scientific work on this process, and it was through this work that he drew the attention of the duPont Company.

In 1902 he was appointed chief chemist of the duPont Company. He established the Eastern Laboratory, and was made director thereof. This laboratory was one of the pioneer industrial research laboratories of the country. Starting from small beginnings over eighteen years ago, the laboratory has been built up on the foundations laid by Dr. Reese, until it has become one of the largest research laboratories in the world.

In 1906 he was placed in charge of the chemical division of the high explosives operating department, where he had not only charge of the Eastern Laboratory but of all the chemical activities of that branch of the duPont Company. His rare executive ability and systematic co-ordination of all the varied chemical interests were so successful that all the chemical interests of the company were consolidated into a chemical department and Dr. Reese was appointed chemical director.

Even before the European war this position was one of great responsibility, as he was in control of the whole chemical work of the duPont Company, which had even then begun to branch out from the explosives industry and at that time employed about four hundred chemists.

Upon the breaking out of the war the responsibilities of this position increased many-fold, but Dr. Reese has always been equal to the emergency. He was always the leader and director in the work of developing new processes and in bringing about efficiency in chemical operations when the war made such demands on the nation. When the European war shut off the importation of many raw materials, the chemical department, under Dr. Reese's leadership, developed new processes for making those materials in this country with such promptness that there was no delay in filling orders for military explosives for our present allies.

Since the war ended, the duPont Company has been engaged in developing the dye industry on a very extensive scale, in which from the nature of the subject the chemical department of the duPont Company has played a most important role. This naturally added greatly to the responsibilities of the department, and under Dr. Reese's direction this great undertaking has progressed most satisfactorily.

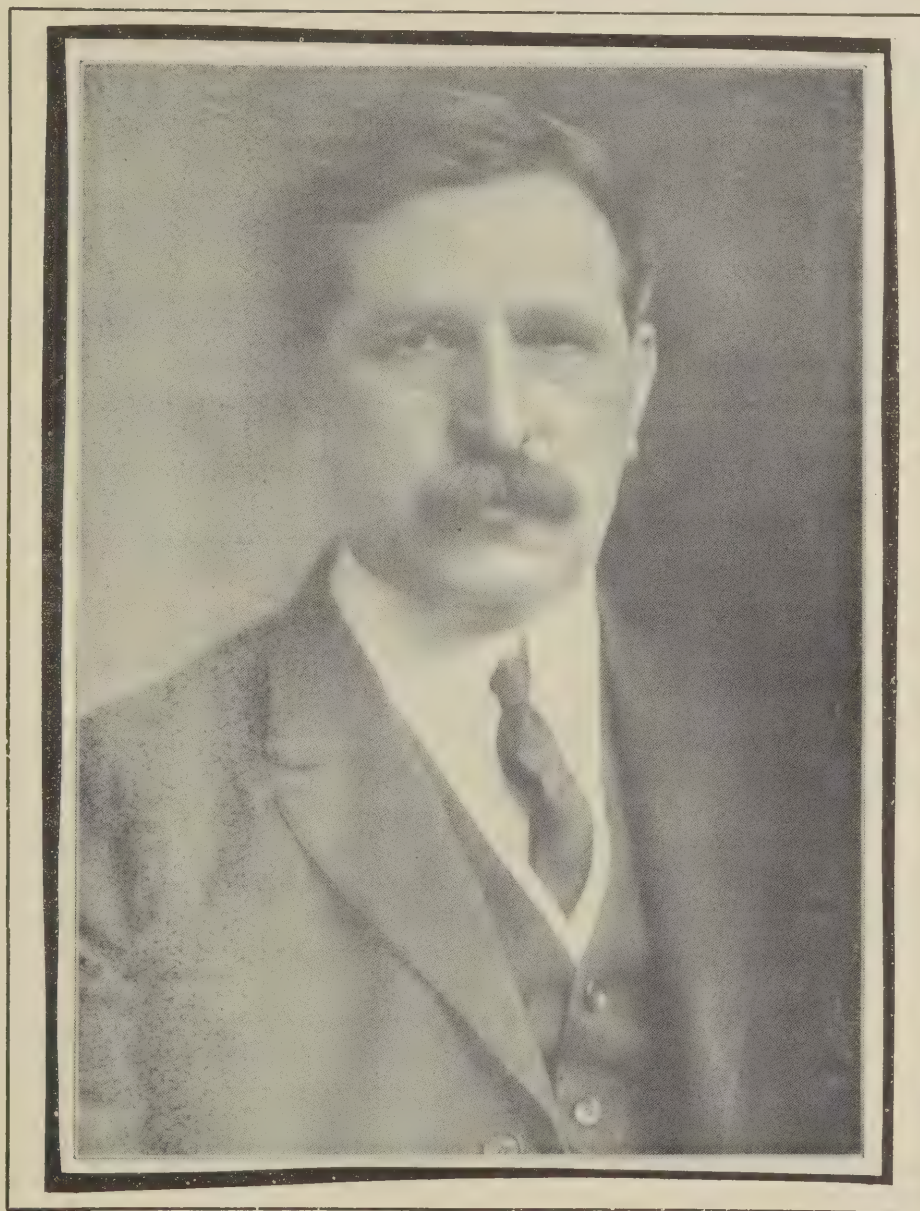
The chemical department of the duPont Company at present is composed of five research laboratories: the Experimental Station, devoted to problems on smokeless powder subjects, ballistics, artificial leather, paints and varnishes, etc.; the Eastern Laboratory, devoted principally to work on high explosives; the Jackson Laboratory, to work on dyes; the Delta Laboratory, to work on pyralin, nitrocellulose plastics, etc., and the Redpath Laboratory, to problems connected with the photographic film industry. Besides the chemists in these research laboratories, there is a large force of chemical experts at the central office in Wilmington, who devote their time to the organization and correlation of the work in the laboratories. At the beginning of this year there were over four hundred chemists in the chemical department of the company. This great organization has been built up under the direction of Dr. Reese, and its success is due to his foresight in planning the organization and his executive ability in carrying out these plans.

In recognition of his most valuable services he was elected a director of the duPont Company in October, 1917.

Dr. Reese is a fellow of the American Association for the Advancement of Science, member of the American Chemical Society, member of the Society of Chemical Industry, member of the American Institute of Chemical Engineers, member of the Franklin Institute, American Academy of Political and Social Science, member of the Chemists' Club of New York, associate member of the Naval Consulting Board and chairman of the Delaware State committee of that body, member of the Wilmington Country Club, and holds membership in many foreign chemical societies.

During the year 1918 Dr. Reese was chairman of the Philadelphia Section of the American Chemical Society and in 1919 was chosen as the chairman of the Delaware Section of the same society. He was also chairman of the Dyestuffs Section of the Chemical Alliance, Inc. He was appointed chairman of the Dye Section of the American Chemical Society, and this year has been elected president of the Manufacturing Chemists' Association of the United States.

THE DYESTUFF FIELD



DR. CHARLES L. REESE

Chemical Director

E. I. DU PONT DE NEMOURS & CO., WILMINGTON, DEL.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the **AMERICAN DYESTUFF REPORTER** by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

S. F. B.—Question: Will you advise me as to the chemical names of the dyes known as "Fur Black" and "Fur Brown"; also as to whether there are other dyes producing different shades on fur and, if so, what are their names and where can they be obtained? Are these colors dyed with a mordant or what is the process?

Answer: The chemical names of the dye known as "Fur Black" is Paraphenylenediamine, and the "Fur Brown" is Paramidophenol. Both of these dyes are used in conjunction with Peroxide of Hydrogen which oxidizes them on the fur. In order to obtain the best results a mordant must be used.

A number of different mordants may be used which will in different cases produce different shades on the skins. Chrome, copper, iron and combination mordants are used in different cases with success. The formula for an ordinary chrome mordant is as follows:

- 2 grams Bichromate of Potash
- ¼ gram Copper Sulphate
- 2 c.c. Acetic Acid 50 per cent
- 1 Liter Water

There are other colors which produce yellowish and bluish-gray shades, which may be obtained in the market.

One concern which specializes in fur dyes is the Seydel Manufacturing Company, of Jersey City, who can supply any of the colors you may need, and would also, no doubt, be glad to give you special information as to their use.

N. H. M.—Question: We submit enclosed two swatches of cotton socks dyed in the same bath. You will note that one comes out darker than the other. Can you give us an idea as to what may be the cause?

Answer: It is impossible for us to give you very intelligent information without knowing more about how these goods were dyed. If you will give us complete details of both your preparatory and dyeing operations, that is, what was done in the way of boiling out or cleansing the goods before dyeing, what preparations were used for this purpose, what dyes were used, and whether the goods were dyed in a dyeing machine or an ordinary tub, perhaps we can give you some definite suggestions.

As a practical proposition, where goods come out different shades in the same bath, one of two reasons is generally the cause—either the goods were not properly prepared for the bath, that is, part of the socks were thoroughly prepared and others were not, or else some of them got into positions in the tub where the circulation

was not uniform. You can readily see that if some of the socks were in the portion of the tub where the circulation was not as good as it was in other portions, those which got the best circulation would be dyed a darker shade. In the same way, if a portion of the goods was thoroughly cleansed they would take the colors more readily than would those which were not so well prepared.

If you do not find the suggested correction of your difficulties in these remarks and will give us full and complete details as to your preparatory and dyeing operations we will be glad to take the matter up further.

R. D. Co.—Question: Can you advise us in regard to who are manufacturing in this country Anthracene Yellow C?

Answer: We have inquired to the best of our ability and are unable to find any American manufacturer of Anthracene Yellow C, which was a former Cassella product.

We are informed, however, that Pontamine Yellow G, manufactured by Du Pont, Alizarine Yellow 3G, manufactured by the National Aniline & Chemical Company, and Chrome Yellow 3G, manufactured by H. A. Metz & Co., are products whose properties very closely resemble those of Anthracene Yellow C.

H. S. Co.—Question: We are occasionally called upon to redye faded woolen garments for our employees or their friends. In many instances the results are most unsatisfactory in that the faded portions come out quite a different shade from the unfaded portions. Can you give us any suggestions?

Answer: There are two methods which we believe will overcome your difficulty.

The first is to bleach the material, prior to dyeing, in a bleach bath made in the following manner: Two per cent of Soluble Oil is weighed off into a pail, 1 per cent of Sodium Peroxide is then added and this is then added to the bath in which the material has been wet out. The temperature should be lukewarm and gradually increased to a boil; boiling is then continued for about 30 to 45 minutes. This will usually bleach the material sufficiently so that it is entirely level. The dyeing can then be accomplished.

The second method is to give the material a light chroming. About 2 per cent of Chrome and 3 per cent of Acetic Acid is used; the material is boiled 45 minutes to one hour and then dyed. The percentage is figured on the weight of the material.

In order to get the best results it is usually necessary to redye in heavy shades only. Unless the material has been very badly faded, either of the methods above will generally be found satisfactory, although, in some cases, the prolonged action of sunlight will be found to have affected the chemical structure of the wool fibers so that no treatment will entirely restore their natural affinity for the dye.

M. N. R.—*Question:* How can I dye silk in shades fast to washing for embroidery threads?

Answer: Neither acid nor basic dyes can be made fast enough for this purpose but you must use direct cotton dyes that will stand after-treatment or development. The ordinary after-treatment with chrome and bluestone is likely to be detrimental to the silk if done too hot but development after diazotization has no bad effect. Colors that will stand Fluoride of Chrome are especially well adapted.

R. P. N.—*Question:* Is there any special method for dissolving Victoria Blue. I had a man from a dyestuff house dissolve a lot perfectly but I am unable to get the dye into perfect solution, it seems that the more I boil it the worse it gets.

Answer: Your question states the trouble exactly; the more this dye is boiled the worse it becomes. It is the nature of Victoria Blue to form a condensation product on boiling, hence it should only be dissolved in water at 170 degrees Fahrenheit. It is best stirred up with water and acetic acid in the cold and hot water added, but not boiled afterward or a bronzy scum will separate and neither a further addition of acid nor more heat will remedy matters.

A. P. P.—*Question:* I have been recommended to use the American equivalent of Diamine Fast Red F as a chrome color on wool. Do you consider it a suitable dye for such a purpose?

Answer: Diamine Fast Red F is a remarkable dye in that it dyes all fibers and works by all the chrome processes. When dyed on wool by after-chrome, chrome mordant or chromate process it has a fastness nearly equal to alizarines and very much brighter. It may be used for shading fancy combinations and will be found to be very economical.

L. P. J.—*Question:* Is there any way that Hydrosulphites can be used for cleaning the hands when stained by dyes?

Answer: As all the hydrosulphites are only effective at temperatures near boiling it has so far not been possible to utilize them for such a purpose. Chloride of lime and soda remain the best things we know of.

V. R. Co.—*Question:* In the AMERICAN DYESTUFF REPORTER, vol. 7, dated September 13, on pages 41-42, is an article under the heading "Color Matching in Daylight and Artificial Light."

We have read this article with interest, and will be pleased if you can furnish us with information descriptive of the lamp used for color matching, and where such a lamp may be purchased.

Answer: The two lamps used by the author of this article are manufactured, respectively, by the General Electric Company, Edison Lamp Works Division, Har-

rison, N. J., and by the Artificial Daylighting Company, 227 West Seventeenth Street, New York City. We have advised both of these concerns that you are interested.

A. K. S.—*Question:* I have been dyeing a navy blue with Blue BH and developing it with Beta Naphthol, but find that it both rubs and washes badly. I dye on a padding machine, on cotton linings, and develop in a similar machine. Is the American dye inferior to the imported in this respect, as I have used the products of three makers and all seem to work alike?

Answer: The difficulty in this case seems to be due to the fact that under the conditions by which the goods are dyed they are more padded than dyed in the first operation. Unless the direct dye is boiled or dyed well on the fiber so it will stand a good rinsing it cannot be made fast by development. Diazotizing and developing simply convert the dyestuff into an insoluble state wherever it may be, and if the color is only loosely attached to the fiber after the dyeing it will still be loosely attached after development. Practically all the American products are equal in every respect to the pre-war type of this dye, since they are identical products in chemical composition and purity.

EXTRACTION OF RESORCINOL FROM THE ALKALI MELT

By HARRY McCORMACK

[Editor's Note—This paper was read before the Dye Section of the American Chemical Society at the recent Chicago meeting, and was inadvertently omitted from last month's Technical Section of "The Reporter."]

The object of the investigation reported herewith was to determine some more economical method of separating resorcinol from aqueous sodium sulphate solution obtained from the neutralization of the alkali melt in which sodium resorcinate is produced, than the customary practice of extracting with ether, or with ether and benzene.

The method worked out effects the separation of resorcinol from the sodium sulphate, sodium sulphite solution by evaporating the solution to such concentration that practically all the sodium sulphate crystallized, leaving all of the resorcinol in solution. The resulting solution is evaporated to complete dryness, pulverized and the resorcinol extracted from the dry mass by treatment with ethyl alcohol or other suitable solvent for resorcinol in which sodium sulphate and sodium sulphite are insoluble.

It is found that with a 72 per cent alcohol solution sodium sulphate is insoluble. Such an alcohol solution dissolves the resorcinol to the amount of more than 50 per cent of the alcohol used and from this alcohol solution it is easy to secure the resorcinol by distilling off the alcohol and then purifying the resorcinol by vacuum distillation. Solvent loss amounts to 1½ to 2½ per cent of the weight of the resorcinol.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 7, NO. 23
DEC. 6, 1920

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

William H. Cady, Chief Chemist of the United States Finishing Co., presents an exhaustive article on the subject of producing khaki shades on cotton cloth. Mr. Cady outlines the historical features of the development of protective colorings for armies in the field and gives recipes for all forms of khaki dyeing.

In Part III. of his treatise on "Water and Its Application in the Textile Industry," Walter E. Hadley deals with the effects of various water impurities on different textile materials and means of correcting same.

George H. Priest, Chemist to the Carpenter-Morton Co., Boston, Mass., discusses the relation of dyestuffs to the varnish industry.

Elvin H. Killheffer, Vice-President of the Newport Chemical Works, Inc., gives his views in support of the proposition to adopt standard methods of dyestuff testing.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incident Thereto

Vol. 7, No. 23

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Section 2

Khaki on Cotton Cloth

Historical Account of the Development of This Shade for the Protective Coloring of Armies—Various Methods by Which Khaki Is Produced—Formulas for Sulphur, Mineral, Wood, Direct and Vat Dyeing of Khaki Shades—Tests for Identifying Various Types

By WILLIAM H. CADY

Chief Chemist, United States Finishing Company

I.—HISTORICAL

"THE adaptation of colour to ground is one of those most interesting operations of nature by which wild animals and insects are protected by an All-wise Providence from destruction by their natural enemies. . . . Nature, who so carefully protects her animal life from injury, teaches man a valuable lesson as regards the colour of uniform with which to equip our soldiers when proceeding on active service in the field."

These words form the introduction of an instructive article on "The Invisibility of the Soldier" written by Lieut.-Col. C. H. Powell of the British army and published in *Blackwood's Magazine* in December, 1899. Colonel Powell would have us realize that our highly developed system of protective coloring for the uniforms of our armies is but the modern adaptation of a natural phenomenon as old as the hills. The nations of the world have been warring with one another for five thousand years, but up to about fifty years ago it seems to have been generally overlooked by military strategists that a soldier's chances of being killed in action might be diminished by making him less conspicuous on the field of battle. Indeed, history shows that the authorities frequently went to the other extreme and made their warriors shining targets for the enemy's fire by clothing them in the brightest possible colors. To quote Colonel Powell: "The predominant uniform of the British army has always been scarlet. If we look at the old records of the many campaigns in which British troops have fought in Europe and on the other continents of the world we shall find that it has almost invariably been the custom for Great Britain to send her soldiers into battle dressed in this colour, no matter in what part of the world the campaign happened to be. . . . It seems that no difference was made in the dress even

in such a climate as India, for we see that in the first war in Afghanistan, from 1839-42, our troops were dressed in red, and must have sweltered under a tropical sun on the plains of Jellalabad in scarlet tunics, pipeclayed belts and musket-slugs, and wearing the old black headdress with a small peak fore and aft. . . . How our soldiers could have stood a campaign under such conditions is not easy to understand in these days of reform." Lord Wolseley once remarked that a British general reminded him of nothing so much as a monkey on a barrel organ.

To-day the scarlet coat has gone forever; it has no place in modern warfare. Military science now demands that the soldier shall be protected from the enemy's bullets in every possible way; that his uniform shall be so colored as to afford him the highest degree of invisibility. And the answer is—khaki.

KHAKI FIRST USED FOR UNIFORMS IN INDIA

A writer in the *Living Age* in 1900 described the origin of khaki as follows: "The word is of Indian derivation and means dust or mud colored. Khaki was worn in India by British regiments certainly twenty years ago, perhaps earlier. India is a land of many climates, so that a good deal of latitude is allowed to the regimental officers as to the way in which their men shall be dressed. A regiment receives from the Indian Government so much money in lieu of clothing which it does not want, and with this purchases clothing which it does. In this way khaki probably came into use. It was worn by the native troops anterior to its adoption by our own men. Khaki is really the color of the soil of India."

Colonel Powell throws additional light on this subject: "Khaki . . . is a mineral dye of a yellowish hue, and has always been much used by the natives. But this Indian dye is of very inferior quality, be-

cause it is not 'fast' and becomes lighter with each successive washing. This was the great difficulty which regiments had to contend with, as they could never keep the uniforms of their men of the same shade. . . . The Indian army had the honour of being the first to adopt this colour. I am not quite sure myself when the introduction took place; but when I first went out to India, in 1880, I found the native troops were dressed in ordinary white drill which had been dyed a khaki colour either regimentally or elsewhere. It is the custom in the Indian army—where almost every article of uniform is paid for by the sepoy himself—for regiments to make up their own uniforms. What they did was to indent on the cotton mills, which are now numerous in India, for white drill in the piece. This was dyed khaki by the regimental dyer, and subsequently made up into uniforms by the regimental tailor. The turbans worn by the native troops, the helmet covers to be worn over the white helmets of British officers covers for water bottles, haversacks, and the webbing which formed the straps thereof—these were all dyed this khaki colour in the bazaars which are attached to each regiment in India."

The first official issue of khaki by the British Government was for the Egyptian campaign of 1882. Khaki has been used in all operations in Egypt since, and has been found as suitable for that country as for India. Just how these early uniform cloths were dyed is not recorded; probably with wood dyes. Two or three years later, however, a process for producing fast khaki shades with a combination of iron and chrome oxides was perfected by Gatti and was promptly adopted by the military authorities. This so-called "mineral khaki" has been the prevailing process for cotton army fabrics in England ever since.

"Lord Roberts, who had just taken over the office of commander-in-chief in India," says Colonel Powell, "was early convinced of the suitability of this colour (khaki) for uniforms on the field, and he went farther: he issued an order to have the whole equipment of field and mountain batteries, including even the wheels and guns themselves, painted khaki. This was a striking change from the dark colour they had previously been painted, and which presented such a contrast to the usual surroundings of an Indian landscape. The rage for khaki at that time was so general that some wit proposed that all horses should be painted khaki before being sent on service! An excellent idea, but unfortunately impractical till someone can manage perhaps to breed out a khaki horse."

U. S. SOLDIERS FIRST WORE KHAKI IN SPANISH-AMERICAN WAR

Khaki uniforms (dyed by the "mineral" process) first came into prominence in the United States in the Spanish-American War of 1898, when they were exclusively used by our troops both in Cuba and in

the Philippines. In the following year the British equipped their South African army in like manner. A writer in *Harper's Weekly* in 1906 remarked: "The first English advance under Lord Methuen to the relief of Kimberley took the field in khaki, with even their buttons and the barrels of their Lee-Metfords painted khaki color." Another observer stated: "The armored trains are painted of a khaki color, while the big guns, the straw hats of the sailors, the bayonets of the infantry, and the swords and lances of the cavalry have all taken over a similar hue." The following incident, observed during this period, is a tribute to the invisibility of khaki: "A company clad in blue with khaki leggings were marching on a hard road, raising no dust, and from an open field 600 yards away they appeared to be cut off right below the knees, just where the leggings ended. The effect was quite startling, to see the progress of the men, apparently unsupported in the air about two feet above the road level."

Up to the time khaki dyed by the "mineral" process had been used exclusively (on cotton). About 1908, however, the U. S. War Department after much experimenting adopted an entirely new shade, which was designated as "olive drab." This was produced with "vat" dyes, and possessed important advantages over the iron and chrome method, particularly in the softness and flexibility of the fabric. The cotton was dyed in the loose state, the warp being a sort of drab and the filling a brownish olive, hence the name. Olive-drab uniforms were used by the army up to 1914, when the cutting off of the supply of vat dyes by the war necessitated a return to the older processes.

VARIOUS PROTECTIVE SHADES FAVORED BY DIFFERENT NATIONS

The great European War found all nations committed to the protective coloring idea but with various opinions as to the particular shade which would furnish the best all-around protection to the soldier. Thus, the Germany army after several years of experiment had evolved a new shade called "field gray," between a green and a gray, and possessing a high degree of invisibility. The French army had adopted a peculiar color known as "horizon blue." The British were still loyal to their khaki. The United States army was also employing this for tents and transport covers; but a modified shade, similar to the earlier "olive drab" but produced with sulphur dyes, was being used for uniforms and other cotton fabrics.

Which of these several shades is the most effective in imparting invisibility to the soldier depends largely upon the character of the background. In the years to come we may expect to see this principle of protective coloring more and more developed, and perhaps the army of the future, like the chameleon, will be able to change its color at will to conform to its

surroundings. Here is a real problem for our research laboratories!

II.—TECHNICAL

SULPHUR KHAKE

The sulphur colors are the mainstay of the khaki dyer in this country to-day. They offer a combination of fastness, utility, economy and rapid production which is not equaled by any other process. Dyeing is occasionally done in the jig, when the shade is particularly deep or the fabric difficult to penetrate; but the great bulk of the work is done in the "continuous machine." The apparatus consists of a padding mangle fed from two storage tanks of about 500 gallons' capacity; from four to eight washing boxes, each of about 300 gallons' capacity, equipped with squeeze rolls (one iron and one rubber), and a similar box for the chroming bath.

The cloth (drills, sheetings, etc.) is not usually bleached, but to obtain good penetration and level shades it should be treated with Diastafor (or similar product) before dyeing, in order to remove the starch with which the warp was sized. This well-known operation is carried out in the open width immediately after singeing, and the fabric is subsequently washed and dried. The dyeing is conducted as follows: The necessary quantities of dyes, sulphide of soda, soda ash and sulphonated castor oil are dissolved in boiling water in the steerge tanks, a typical formula being given below:

(For 500 gal. liquor)

Sulphur yellow brown.....	80 lb.
Sulphur olive	80 lb.
Sulphur yellow	20 lb.
Calcined sulphide of soda.....	140 lb.
Soda ash	24 lb.
Sulphonated castor oil.....	100 lb.

This dye liquor is piped directly to the padding box, through which the cloth is drawn at the rate of 60 to 70 yards per minute. The best practice is to pass the fabric twice through the dye-bath, squeezing after each passage. This is accomplished by the use of a three-roll mangle, usually consisting of an iron roll in the center with rubber rolls above and below it. The correct setting of the squeeze rolls has an important bearing on the uniformity of the shade.

The cloth on leaving the dye-bath travels 20 or 30 feet through the air in order to oxidize the color partially before being washed (otherwise there will be a large and unnecessary loss of dye in the subsequent operations). It is now washed thoroughly with running water, in order to remove as much sulphide, etc., as possible before the chroming operation which follows. The chrome liquor is made by dissolving 5 pounds bichromate of soda and 5 pounds copper sul-

phate in 100 gallons boiling water in a storage tank and adding sufficient acetic acid to keep the chrome bath constantly acid (the amount varying according to the thoroughness of the previous washing). This liquor is fed continuously into the chroming box by means of a perforated pipe. The temperature of the bath should be from 110 to 120 deg. Fahr.; a higher temperature has a tendency to strip the color. The object of the chroming operation is to complete the oxidation of the dye and to increase its fastness to washing and light. If the chroming is omitted it is practically impossible to control the shade, which will vary from piece to piece according to the degree to which it has oxidized in the air. The cloth is now washed thoroughly again and is finally dried. By using this process it is possible to run continuously from start to finish, with a production as high as 35,000 yards in a ten-hour day.

When dyed properly, sulphur khaki shades are well penetrated and level, and the fastness to washing, acid, alkali and perspiration is excellent; the color is moderately fast to light, varying somewhat according to the particular dyes used, while the resistance to chlorine is poor.

Sulphur khaki was extensively used during the great war for dyeing fabrics for uniforms, shelter tents, shirtings, leggings, gas masks and other military equipment. At present it is in considerable demand for workmen's clothing, ladies' suitings, children's dresses and many other purposes where fastness to washing and perspiration is essential.

MINERAL KHAKE

The term mineral khaki is applied to a process whereby certain metallic oxides, chiefly iron and chrome, are deposited on the fiber, producing a yellowish brown shade. It will be observed that the coloring matter is purely inorganic, in which respect this process differs from all the others. It has the distinction of being the first method for the production of khaki shades which was satisfactory from the standpoint of fastness. Even to-day, after thirty-five years, it is still the approved color for British cotton uniforms. In this country it finds considerable application in the manufacture of tent cloths and similar fabrics, but has been displaced by sulphur colors for most other purposes.

A favorite method of producing mineral khaki on cotton cloth is the one which is given in Knecht's "Manual of Dyeing," as follows: "The scoured cloth is passed through a mixture of ferrous and chromic acetates which stands at 36 deg. Tw., being given two dips in the padding machine, after which it is dried on wrapped tins. After drying, the cloth is steamed for four minutes in a rapid ager, in which the steam and air are maintained at a temperature of 220 deg. Fahr. The goods are then passed through a boiling solution of caustic soda and soda ash standing at 12

deg. Tw. The proportion of caustic soda and soda ash in the fixing liquor is one to three. A mineral khaki contains from 5 to 7 per cent ash."

The action of the steam is to dissociate the acetates, liberating acetic acid and depositing the metals on the fiber as insoluble oxides. The boiling alkali bath neutralizes any acid remaining in the cloth and completes the precipitation of the oxides.

AMERICAN METHOD FOR MINERAL KHAKI

As used in this country the above process is sometimes slightly modified. The aging is prolonged to eight minutes and, instead of caustic soda, soap is used in the fixing bath. Also it is usually unnecessary to employ so strong a padding liquor. A typical formula for making up this liquor, used on a larger scale on 12-ounce duck during the war, reads as follows:

Acetate of chrome 32 deg. Tw.....	180 gal.
Iron liquor 21 deg. Tw.....	180 gal.
Water	180 gal.

The iron liquor used in this formula is a crude ferrous acetate. It should be entirely free from tarry matter.

This process gives excellent results and is capable of an output of 30,000 yards per ten-hour day. The following precautions should be taken: The impregnation in the padding machine must be absolutely uniform and the cloth must be squeezed evenly, otherwise streaks will develop; and the drying cans must not be too hot (about 5 pounds of steam is sufficient), as too rapid drying also has a tendency to produce streaks. If the goods are unusually hard to penetrate, it is better to run them from the padding mangle directly on to a batching roll so as to give the liquor a chance to soak into the cloth before drying. It is important that all size should be removed from the fabric previous to dyeing.

The original mineral khaki process brought out by Gatti in 1885, and still used on an immense scale in England, is somewhat different from that previously described. The cloth is first thoroughly scoured with soda ash in a heavy mangle, washed and dried. It is then padded with a mixture of chrome alum and chloride or nitrate of iron (preferably the nitrate) and run on a batching roll. The drying is done in a "hot room," where the bulk of the moisture is driven off by hot air, and the last traces removed by a passage over two or three cans (this method of drying is said to give more even results than when the cloth is dried entirely on the cans). The goods are now passed at once (without aging) through a boiling caustic soda bath, which precipitates the chrome and iron oxides on the fiber. To improve the fastness to perspiration and acid the cloth is subsequently treated in a hot solution of silicate of soda. In place of the salts al-

ready mentioned, the bisulphites of chrome and iron may also be used in the padding bath.

Mineral khaki shades are noted for their fastness to light, alkali, washing and chlorine, but are sensitive to acids. The process also has the serious disadvantage of imparting a harsh, stiff "feel" to the cloth which gives much trouble in sewing, the metallic oxides in the fiber making it difficult for the needle to penetrate. The sensitiveness to acid, as already mentioned, can be overcome to a certain extent by an after-treatment with silicate of soda. The harshness of the fabric can be lessened by a final passage through a hot solution of glycerin and ricinoleate of soda.

An important point to be noted is that fabrics dyed with mineral khaki are practically waterproof. This is doubtless one of the reasons why the process has so long retained its popularity for army cloths, and particularly for tests.

WOOD KHAKI

Khaki shades produced with the dyewoods were in considerable demand during the early years of the war, when direct and sulphur dyes were scarce. They have now, however, become relatively unimportant on account of their fugitiveness and the technical difficulties which they present to the dyer. Briefly, the process consists in impregnating the cloth with a solution of the dyewood extracts, and subsequently developing the shade by treatment with a metallic salt. This process may be carried out in either a continuous machine or a jig. Nearly all the principal dyewood extracts may be utilized: quercitron bark, fustic, aurantine, cutch, hypernic, logwood, and even sumac. The last-mentioned, though not strictly a dyewood, when combined with chrome gives a very good brownish yellow shade of considerable fastness.

In jig dyeing the cloth, previously bleached or "disastaford," is passed through the dye-bath (consisting of the dyewood extracts without further addition) from three to six times at the boil, and is then wound up on a batching roll. The dye-bath is replaced by a cold copperas solution and the cloth is given two ends in this liquor and is batched again. A solution of bichromate of soda is now prepared. The cloth passes twice through this bath at about 120 deg. Fahr., and is finally washed in two hot waters and dried.

The continuous process is somewhat different. The dye liquor is applied in a padding mangle fed from a storage tank in which the extracts are boiled up. The cloth is impregnated with the dyewood solution, is well squeezed, and immediately dried on a set of dry cans of which the first eight or ten are lapped. As it leaves the cans it is subjected to live steam for about thirty seconds in a small ager. The color is next fixed by a passage through a boiling solution of bichromate of soda fed from another storage tank. Two cold washes follow, and the cloth is finally mangled and

dried. The entire process is continuous and is capable of a large production when everything is right; which, unfortunately, is seldom the case. The chief difficulty is the frequent occurrence of "scrimps" or streaks caused by wrinkles in the cloth in the padding operation. Drops of water falling on the fabric before chroming also show in the finished goods; and the dye extracts have an unpleasant habit of "building up" on the dry-cans.

Wood khaki is pretty fast to washing and alkali, but only moderately fast to acid, and poor to light and chlorine. All in all, it has little to recommend it when other colors are available. Its chief use has been on drills and sheetings for workmen's clothing.

DIRECT KHAKE

Direct colors are used in the production of khaki only where the fastness to light and weather is of no consequence. The usual methods of application—padding and jig dyeing—are employed. Aside from their economy and the simplicity of the dyeing operation, these dyes have little to recommend them and are seldom used for khaki.

VAT KHAKE

Many attempts have been made to utilize the vat colors for khaki shades on account of their wonderful fastness, surpassing that of all other known dyes. Up to the present, however, no practical method has been devised for dyeing uniform shades continuously with vat dyes in the piece, partly on account of the difficulty in keeping the dye-bath of a uniform composition, partly on account of the oxidation constantly taking place both in the bath and on the fiber. It is perfectly possible to dye a level shade on a single roll of cloth, but it is next to impossible to duplicate the shade on another roll. Doubtless the problem will be eventually solved, but the scarcity and high price of the vat dyes to-day discourage further endeavor along these lines.

The sample may be assumed to have been dyed with one of the above families of dyes, namely: sulphur, mineral, wood, direct, or vat.

1. Boil in a solution of caustic soda and hydrosulphite of soda. Direct khaki is permanently decolorized or reduced to a pale yellow. The other khakis are only temporarily affected, the original shade returning on washing.

2. Boil in a 5 per cent solution of muriatic acid. Mineral khaki is entirely destroyed. Wood khaki turns to a red-brown and the acid solution is colored yellowish. Sulphur and vat khakis are not affected. On neutralizing the acid with caustic soda, the shade of the wood khaki becomes much darker; the solution remains yellow.

3. Special test for sulphur khaki. Boil the sample

a few seconds in a test tube in equal parts of tin crystals, muriatic acid and water, holding over the mouth of the tube a piece of filter paper moistened with lead acetate solution. If sulphur colors are present, a dark brown spot (lead sulphide) is formed on the paper. This test must be made with care, and long boiling must be avoided.

4. Ignite the sample and examine the ash. Presence of iron in large quantities accompanied by chrome indicates mineral khaki. Chrome without iron (or only a trace) points to sulphur or wood khaki. Absence of metals suggests either direct or vat colors; infrequently sulphur colors.

There is no special test for vat dyes. They are usually recognized with a little practice by their characteristic change of color when reduced with hydrosulphite, the original shade returning on subsequent oxidation.

In all cases identification should be established by at least two tests, whenever possible, to be on the safe side.

TEN RULES FOR OVERSEERS

The following ten rules for foremen appeared in our contemporary, the *Central Station*:

1. Be fair.—Have no favorites and no scapegoats. A foreman has to act as judge many times every day. Therefore, he must be just.

2. Make few promises and keep them.—A foreman must be exact in this particular. Sometimes a foreman forgets that his job requires a high standard of truth and honor.

3. Don't waste anger. Use it.—Anger is the most valuable thing, and should not be used carelessly. Keep your most forceful language for special occasions. Before a foreman can control others successfully he must control himself.

4. Always hear the other side.—Never blame a worker until he has been given a chance to give his point of view.

5. Don't hold spite. Forgive.—When you have had to scold a worker, go to him later in a friendly way. There should always be blue sky and sunshine after a storm.

6. Never show discouragement.—Never let yourself be beaten. A foreman must have perseverance, and never say die.

7. Notice good work as well as bad.—Mingle praise and blame. Let the workers see that you can appreciate as well as condemn.

8. Watch for aptitudes.—Take a keen human interest in your workers. Notice them. Study them. Put each one where he can do best.

9. Be an optimist.—Don't let your worries and troubles deform you into a pessimist. Inspire confidence. Put the "right" spirit into the works. Say, "Come along, men, all together!"

10. Take your full share of the blame.—This is the most difficult of all. It is heroic. But the foreman who can share both blame and praise with his workers will have discovered the secret of managing his men.

Water and Its Application in the Textile Industry—Part III.

The Effect of Water Upon Various Types of Textile Material

By WALTER E. HADLEY

WHEN dealing with the subject of water, one should bear in mind that absolutely pure water is the oxide of hydrogen and consists solely of two parts of hydrogen and one part of oxygen, as shown by formula H_2O . Pure water, in the majority of cases, is not injurious in its action on textile material. As already pointed out, pure water is possible only for use in scientific work and must be specially prepared when required.

In considering water and its action upon the various types of textile materials the problem immediately resolves itself largely into a consideration of the impurities occurring in the different waters and their subsequent action upon the material, and not primarily the action of the water itself.

In other words, if it were possible to use a pure distilled water the troubles of the textile bleacher, dyer and finisher would be very greatly reduced.

An outline will herein be given of the action of pure water, as well as the action of waters containing different impurities, upon textile fabrics composed of wool, cotton, silk, linen, jute and artificial silk, and mixtures of any of these fibers.

WOOL

The natural wool fiber as it is taken from the sheep is in a very impure condition, containing wool grease and dried sweat (suint). In this condition it easily repels the action of water, and even after scouring in a soap bath containing potassium carbonate or sodium carbonate the cleansed wool fiber is more or less difficult to wet out.

Wool is quite hygroscopic in its nature, losing about 18 per cent of water when dried at 100 deg. Cent. A continued boiling in pure water gradually affects wool and a decomposition sets in whereby ammonia and hydrogen sulphide are set free and the luster and tensile strength of the wool are impaired. Water containing a small amount of acid does not exert as harmful an action upon wool as does pure water.

Wool is seriously affected by the action of steam. If steamed at 100 deg. Cent. wool loses as high as 75 per cent of its strength in two and one-half days.

If wool is heated to 100 deg. Cent. and its moisture retained, it assumes a plastic condition and can be brought into any desired shape, which will be retained, more or less permanently, if the wool is allowed to dry in this condition.

If water containing wool is heated to 130 deg. Cent., the wool, after thorough drying, can be pulverized by rubbing.

Wool contained in water heated to 150 to 200 deg. Cent. will be absolutely decomposed. If wool is subjected to gentle heat in a damp condition, mildew is very liable to be produced and rapidly attacks and destroys the fiber. The mildew spots are very apt to act as a resist in dyeing, showing up as uneven and light spots in the finished fabric. Mildew when once formed is practically impossible to remove.

COTTON

Water does not exert an injurious action upon cotton fiber under normal conditions. A deleterious action is brought about when cotton is treated at 150 deg. Cent., a decided loss in tensile strength being noted. If cotton is heated as high as 200 deg. Cent. in the presence of water, a decomposition sets in and such products as carbon dioxide and formic acid are formed. If steamed for an extended period of time at 100 deg. Cent., the cotton fiber is tendered. Cotton fiber while wet possesses greater tensile strength than when in the dry condition.

SILK

Silk is very hygroscopic in nature, and can hold as high as 30 per cent of its weight of water and still appear dry.

In order to obtain uniform conditions in the purchase and sale of silk it is necessary to have the moisture accurately ascertained, and this is accomplished in "conditioning houses," which are located in the principal silk districts.

An amount of moisture equivalent to 11 per cent is allowable in silk.

If silk is boiled with water for an extended period of time the fiber is slightly weakened, but the action is not nearly as pronounced as in the case of wool.

LINEN, JUTE AND HEMP

Linen is more or less hygroscopic in character, easily containing 6 to 8 per cent of moisture.

Jute shrinks somewhat and loses slightly in tensile strength when boiled in water.

Hemp is not often bleached or dyed. It is used for

making ropes, bags, canvas, etc., for which uses it is particularly adapted owing to the fact that it does not readily rot when immersed in water for long periods of time.

ARTIFICIAL SILK

Artificial silks require extreme care in handling when same are in the wet condition, as their tensile strength is greatly diminished. They, however, regain their full original strength again upon drying.

ACTION OF WATER CONTAINING CALCIUM AND MAGNESIUM IMPURITIES

GENERAL

Attention has already been drawn to the fact that the calcium and magnesium impurities exert a deleterious action in the case of boiler-feed waters, and the trouble is no less marked when water containing these impurities is used in the bleaching, dyeing or finishing of textile materials.

The trouble encountered in the use of water containing these impurities is due largely to their action with soap, whereby an insoluble calcium or magnesium compound is produced. A "hard water," in common parlance, is one which will not produce good suds when soap is added thereto. Instead of immediately obtaining an abundant lather, a milky appearance is imparted to the water and no permanent suds will be produced until such time as all of the calcium and magnesium present have been precipitated as insoluble soaps. In addition to the wastage of good soap*, which at present prices presents a very serious factor, it should be borne in mind that the insoluble soaps will cause an endless amount of trouble in the various processes which textile material must undergo before it is ready for merchandising. The soaps of calcium and magnesium are, from a chemical point of view, just as true soaps as are those of sodium and potassium, the difference being that the sodium and potassium soaps are easily soluble in pure water, whereas the calcium and magnesium soaps are insoluble and exist as a thick, viscous mass. These calcium and magnesium soaps are clear and colorless when fresh, but are very liable to turn dark with age, depending upon the nature of the grease used in compounding the soap. While it is sometimes possible to remove this substance from textile material with which it may come in contact, it is, needless to say, far better to avoid the formation of same. As already mentioned, the condition which produces the hard-

ness can easily be overcome, in the original water, by passing same through a zeolite softener. Thereafter but little soap will be required to form a permanent lather, and the objectionable features introduced by the formation of an insoluble soap will be avoided.

A hard water is unsuited for dissolving many coal-tar dyestuffs; for instance, methyl violet will precipitate as a tarry substance.

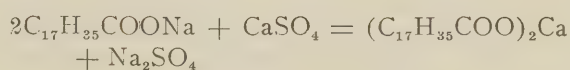
In dyeing alizarine or logwood a certain amount of lime in the water is absolutely necessary, but it would be far better to use a pure water and add the proper amount of lime to the bath.

DOUGH BALLS

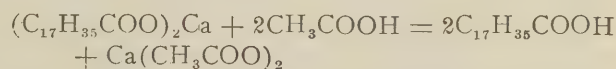
The so-called "dough balls" are oftentimes a source of great annoyance. They appear as little round balls or clots of varying sizes, and adhere very tenaciously to any material with which they may come in contact. They are formed by the action of soap in the presence of hard water, whereby an insoluble soap is precipitated upon and within the material. They cause grease spots, which soil bleached material and produce uneven dyeings.

If the above condition does occur it is often possible to remove the spots by treatment with a solution of acetic acid. This treatment forms a soluble acetate, with the metallic element producing the hardness, and liberates the fatty acid of the soap. A rinse removes the soluble acetate, and a subsequent alkali treatment forms a soluble soap with the liberated fatty acid and is easily washed from the material.

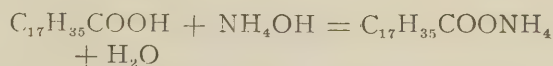
The chemical reactions taking place in the above would be as follows:



i. e., ordinary sodium soap + calcium sulphate = insoluble calcium soap + sodium sulphate.



i. e., insoluble calcium soap + acetic acid = stearic acid + calcium acetate.



i. e., stearic acid + ammonium hydrate = ammonium stearate + water.

WOOL

Wool is scoured in a soap bath containing potassium or sodium carbonate. The use of a water containing calcium or magnesium impurities would, therefore, in addition to forming the insoluble calcium and magnesium soaps, produce the insoluble carbonates of these same substances. The presence of these insoluble calcium or magnesium compounds would ren-

*Note—A water possessing 1 deg. hardness will destroy 1½ pounds of a good grade of soap for every 1,000 gallons of water used. For example, a water containing 10 deg. of hardness will destroy 15 pounds of soap for every 1,000 gallons of water used.

der the woolen or worsted material extremely harsh in feel, and would subsequently result in an uneven bleaching or dyeing.

The use of a hard water in fulling would be particularly undesirable owing to the fact that the insoluble soaps would be so firmly imbedded in the woolen material as to render their removal impossible.

COTTON

The use of water containing either temporary or permanent hardness is objectionable in the "boil-off" preceding the bleaching of cotton material, inasmuch as the presence of calcium or magnesium salts in the water would cause a precipitation of calcium hydroxide or magnesium hydroxide which, aside from destroying soap, would cause a deposit to settle upon the material being treated. The deposit of calcium and magnesium hydroxides could be eventually removed if given a sour in muriatic acid.

If treated with oil of vitriol the calcium hydroxide would be converted into more or less insoluble calcium sulphate. The magnesium hydroxide would be converted into soluble magnesium sulphate and could be easily removed.

SILK

The action of hard water is objectionable with all types of textile materials, but particularly so upon silk. Silk, in the first place, is one of the most valuable fibers with which the textile manufacturer has to deal. Obviously, any condition which would tend to render the silk fiber harsh, or add anything thereto which would in any way interfere with the succeeding treatments which the silk would have to undergo, would be decidedly objectionable.

The function of the preliminary steps in the treatment of silk is to remove all foreign matter and leave only the true silk fiber. The removal of the silk gum or sericin is brought about by the so-called "boil-off." The boil-off bath is prepared from pure soap and water. If the water contains any calcium or magnesium salts, then an insoluble soap is immediately precipitated in the bath and floats as a scum on the surface of the liquor. An endeavor is always made to remove this sum by scraping same together and then removing from the surface with a ladle or dipper. Even if it were possible to remove all the scum floating on the surface and that which adheres to the sides of the vat, it should also be borne in mind that the entire liquor within the bath is still filled with finely divided particles of the insoluble soaps, which have not clotted together but which would be equally dangerous when in contact with the silk.

The only way to insure the absence of these insoluble soap formations is to use an absolutely soft water, and this condition is only possible in one of two ways;

i. e., either use a naturally soft water or one which has been softened by a treatment with zeolite.

WEIGHTING OF SILK

One of the most important treatments which silk receives is the "weighting," and in order that this process may be expeditiously carried out it is absolutely essential that the silk material come from the "boil-off" bath perfectly clean and free from all foreign matter.

If grease spots are present upon the silk, then the tin chloride does not uniformly impregnate the silk and the subsequent formation of tin oxide will also be unevenly distributed over the surface of the silk material.

DYEING OF SILK

Silk which has received an uneven "boil-off" will not take the dyestuff in a uniform manner; with some dyestuffs the presence of the insoluble soap acts as a "resist," by means of which the dyestuff is held off from the silk, while with other dyestuffs the insoluble soap would act as a mordant and cause a more pronounced deposition of color upon the stained portions.

THE ACTION OF IRON IMPURITIES

WOOL

The use of water containing iron is to be avoided in the processing of wool, as mordant colors are practically all rendered duller in conjunction with iron. In bleached material the shade would not be clear in the presence of iron.

COTTON

The waters containing iron should not be used in bleaching beyond the point where an acid treatment is given.

If traces of tannic acid remain in the material from improper "boil-off" the white will be dull, owing to formation of iron tannate.

SILK

The presence of iron in water used for the processing of silk would act in a similar manner as would calcium and magnesium impurities, an insoluble soap being precipitated upon and within the fiber.

Further, the presence of iron, not necessarily in conjunction with soap, would tend to produce rust stains, particularly upon bleached silk. If iron was present in water used for dyeing of silk, a precipitate would be produced with many dyestuffs which would not only cause a decided loss of the valuable dye but would also be the cause of producing uneven dyeings.

The use of water containing iron is to be avoided whenever possible in the treatment of all types of textile fabrics.

THE ACTION OF ACID IMPURITIES

The presence of natural acid impurities in water would be to increase slightly the consumption of soap. Such waters would not be particularly objectionable in the dyeing of wool and silk, which are both dyed from an acid bath; but even so, it would be far more satisfactory to use a neutral water, and then employ the type of acid and the quantity desired.

THE ACTION OF ALKALINE IMPURITIES

The presence of alkaline impurities would be objectionable rather than otherwise in the processing of silk; the alkalinity would have to be overcome by the addition of some form of acid, such as acetic, tartaric, etc.

The presence of alkaline impurities in some instances might be considered advantageous in the scouring of woolen material.

The presence of alkaline impurities would have a tendency to precipitate certain dyestuffs which, in turn, would produce uneven dyeings.

DYES AND THE VARNISH INDUSTRY

By GEORGE H. PRIEST

Chemist, Carpenter-Morton Company, Boston, Mass.

"**P**AINT and Varnish" has a familiar appearance to those of us who have observed the united movement of the trade during the last few years to awaken the public to the fact that you "Save the surface and you save all."

We may conceive of paint being used to cover wood, metal, concrete, plaster, brick, etc., and it serves a two-fold purpose: First, to protect the surface from the elements, and secondly, to present a tasteful color scheme which is restful and attractive to the eye. The prerequisite quality of a paint, as distinguished from a varnish, is its hiding power—it contains pigment which renders the coating opaque and the surface itself invisible to the eye.

On the other hand, varnishes are usually transparent. They are composed largely of solutions of imported gums which give a clear, glossy, protective coating to the surface upon the evaporation of their volatile constituents or the oxidation of the drying oils. This transparent feature is the chief advantage a varnish enjoys over a paint for interior finish. For instance, it would seem a pity to apply a coat of paint to a hardwood floor, thus hiding the surface, when a properly selected varnish would serve as well for protection and in addition would preserve the grain and color of the wood in all its natural beauty.

Just as every article of value has its substitute or imitation, it has become the custom for certain furniture manufacturers to finish an inferior grade of wood so as to resemble closely the more valuable varieties, thus enabling them to supply an article which will meet the demand of an eye which is none too critical and a pocketbook which is none too fat. In the same way interior decorators will convert a whitewood floor or standing finish into an excellent imitation of oak, mahogany, cherry, etc. It is in this connection that the use of coal-tar colors becomes an important factor in the manufacture of varnish.

There are two ways in which an experienced man may bring about the desired result. The first is by the use of alcohol stains. As may be expected, these consist essentially of spirit soluble colors with alcohol as the conducting medium, although the alcohol may be diluted with chemicals which will aid in penetrating the surface, such as acetone or benzol. The chief objection to the alcohol stain is that it strikes in so quickly that it is difficult to obtain an even depth of shade.

The so-called oil stain is superior in both these respects and can be produced at less cost to the manufacturer. These stains involve the use of the oil colors, which require the use of benzol or solvent naphtha to put them into solution, **because of the presence of stearic acid**. The body of the stain consists of various oils, and as these do not penetrate as the alcohol stains do a small amount of varnish is often used as a binder to prevent the color from being rubbed off.

After applying either an alcohol or an oil stain the surface may be left unfinished, but it is customary to apply one or more coats of varnish to a floor or furniture as a matter of protection. The general trend in varnish manufacture, as in other industries for the past twenty years, has been to speed up. Whereas a good floor varnish a few years ago would dry in three or four days, the present demand is for one that will dry overnight. There has also been a growing tendency to place upon the market a series of economy products by means of which an inexperienced person may imitate the work of the skilled artisan. These two factors have combined to produce the varnish stain, which is to-day a popular and fast selling paint specialty.

THE VARNISH STAIN

The idea of the varnish stain is indicated by its name. Suitable colors are incorporated in the varnish so that upon application to natural wood the result approximates that obtained by separate treatment with stain and varnish. In this way one operation is eliminated and when one does one's own work there is a saving in labor, which is the greatest factor in present high costs. The varnish stain's usefulness is not limited to the finishing of new wood, but opens the way to rehabilitating unsightly floors which have been worn until they have become eyesores. The floor is first given a coat of neutral "ground color" which hides the surface and serves as a foundation for the varnish stain, but before application of the stain it is

gone over with a special "graining surfacer," the liquid constituents of which are volatile. By marking this surfacer with a rubber roller before dry an inexperienced worker may imitate the natural markings of the grain of the various woods, and graining tools are provided for the expert which produce high grade work. A coating of varnish stain may now be applied and reveals an imitation of new wood which will stand close inspection.

From the varnish stain to the color varnish is but a step. While the varnish stains were originally intended to reproduce the natural colors it is readily seen that for other purposes countless other colors are desirable and available. The array of toys in bright and striking colors affords an excellent example; the varnish is superior to paint in that it is non-poisonous, better drying, and more adhesive to metal surfaces. How easy to dress up an army of toy soldiers by the use of the color varnish!

THE COLOR VARNISH

In the discussion of the color varnish we must recognize the enamels which are properly on the border line between paint and varnish and are sometimes classed as either. Enamels resemble paints in that they are opaque and generally contain pigment rather than soluble colors. However, they are ground in varnish instead of linseed oil and dry with a gloss due to the presence of the gums. They may be prepared in a variety of colors and used when hiding power is a desirable feature.

The uses of the color varnish are limited only by the imagination of a resourceful and progressive manufacturer. We may cite as an example the experience of a leading New England paint and varnish house whose products have for years been known all over the United States as well as in foreign markets. Among them was a black varnish which was used for many purposes, covering leather, basketry, etc. Somebody who was familiar with its success on straw conceived the idea of using it for touching up ladies' straw hats which had lost their natural finish. This idea opened up tremendous possibilities and the manufacturers were quick to seize the opportunity and to offer a line of varnishes in all the fashionable colors of the millinery trade. Now the name of "Colorite" has a definite meaning to millions of women and its production is a source of revenue to many dyestuff manufacturers.

Next to the shade the important factors in the selection of dyes for varnish are their solubility and fastness to light, and the buyer should be guided in his purchases by the report of his laboratory.

In this article the writer has attempted merely to outline the use of dyestuffs in a field which is not familiar to most of our chemists, who are chiefly concerned with the application of dyes to the fiber by means of aqueous solution. It is well to recognize that coal-tar colors are not universally used. In many of the cheaper stains and varnishes pigments are used, as raw sienna or chrome green, which are insoluble and consequently settle out in the can, making it impossible to obtain a product which

will be clear and uniform throughout. Then, too, the vegetable dyes, such as santaline, extracted from sandalwood, or carthamine, from safflower, are faster to light and are sometimes used for this reason. However, the coal-tar dyestuffs are in general demand in the varnish trade; our manufacturers are after the business and are co-operating so that in this line, as in so many others, we may pin our faith on dyes "Made in America."

BURNS FROM CAUSTIC SODA AND THEIR REMEDIES

Solid caustic soda and caustic soda liquor of even moderate strength, especially if hot, attacks clothing quickly, and attacks the flesh. Caustic soda is especially active in contact with the delicate structures of the eye or the interior of the mouth. For these reasons it is necessary to avoid its contact with the skin, and to adopt means for immediate treatment in case contact occurs. For immediate first-aid treatment of caustic soda burns, dilute acetic acid is used. It is prepared from good quality commercial acetic acid by diluting it to an exact content of 2 per cent actual acetic acid. If the commercial acetic acid be of 30 per cent strength, one quart of it is added to fourteen quarts of water to give 2 per cent strength. After this dilution the acid is analyzed to make sure that its strength is 2 per cent.

When an employee receives a caustic burn, this dilute acetic acid is applied immediately. It instantly neutralizes the caustic soda and converts it into harmless sodium acetate, and the injurious action of caustic upon the flesh or clothing is stopped. With serious burns application of dilute acetic acid is immediately followed by carron oil, which has a soothing effect. In case of eye burns, the eye is thoroughly washed with acetic acid, and then sweet oil is applied. It is important that no absorbent cotton be used for cleansing the burn, because fibers of the cotton become imbedded in the wound. They interfere with the healing, and present danger of infection.

In order to identify the dilute acetic acid as a first-aid material, a small amount of cochineal solution is added to color it red. In general, the handling of soda ash or sodium bicarbonate presents no accident risks, but caustic soda, either solid or liquid, must be guarded against. The best safeguard against all conditions of caustic soda burns is to have a supply of 2 per cent acetic acid solution always at hand, in clean bottles, close to every place where caustic soda is handled. With these precautions, and with workmen trained to use the acetic acid immediately, serious burns from caustic soda need rarely happen.

BLACK, AND LAUTH'S IMPROVEMENTS

In Lightfoot's process (1863) for the printing of aniline black on cotton, the mixture recommended to be printed consisted of aniline, hydrochloric acid, acetic, copper chloride, and chlorate of potash, suitably thick-

ened with starch. The printed goods were aged for three days, washed, and soaped, or passed through a dilute solution of bleaching powder, whereby an intense black was produced. During the ageing, the acid decomposes the chloride of potash, and the liberated chloric acid and the cupric chloride, reacting on the aniline, produce the insoluble aniline black which remains fixed on the cotton. It may be recorded that the beauty and luster of the black thus obtained caused it to be used extensively in England, France, Switzerland and Germany; but the excess of acid and the copper chloride attacked the rollers and doctors of the printing machines so strongly that the process fell into disfavor. Moreover, the mixture would not keep for any length of time at the ordinary temperatures, the reaction which produces aniline black taking place in the mixture itself, so that the color being no longer formed on the fibers itself would not adhere. Lauth succeeded in obviating this inconvenience by substituting the insoluble copper sulphide for the acid chloride of copper, and in January, 1865, took out a patent for the new process. The mixture, suitably prepared, was composed of sulphide of copper, aniline hydrochloride, ammonium chloride, chlorate of potash, duly thickened. After printing, the black was developed by ageing for twenty-four hours at 70 deg. Fahr., and then washing thoroughly. In this mixture the sulphide of copper is gradually converted into sulphate by the oxidizing action of the hydrochloric acid and chlorate of potash, and then acts as the chloride of copper does in Lightfoot's mixture. As the soluble salt of copper does not exist in the mixture, when printed, but is only formed gradually on the fiber, it does not affect the rollers and doctors, and the mixture can be kept in a cool place.

INFLUENCE OF MOISTURE ON THE SHADE OF DYEING

By J. ROUFFIN

ALL dyers have noted that dyeings with some coloring matters are modified by heat, usually the shade is reddened. Yellow shades appear more like orange, and orange shades more on the scarlet side. This alteration of the shades takes place slowly. In most instances, the lapse of a couple of hours will be required before the return of the original shade.

It has also been observed that the modification of the shade depends largely on the nature of the coloring matter employed; some are extremely sensitive to heat, and others not at all. When using those that are very sensitive to heat, precautions should be taken in the course of matching off. Samples taken from the dyeing should only be dried at a high temperature when it is desired to ascertain quickly the state of progress of the dyeing. The final matching needs to be accomplished with more precaution.

As to the cause of the phenomenon, the opinion gen-

erally held is that it is due to a specific action of the heat on the coloring matter. This interpretation is, however, open to doubt for the following reasons: (1) The shade changed by heat only returns slowly to its initial tone long after the temperature of the material has fallen to that of the surrounding atmosphere, and (2) the color of the material as it leaves the boiling liquor is the same as that of a wet but cool pattern from the same batch, and in both cases the color is different from that of a dry and cold sample, but the difference is in the inverse sense from the variation produced by heat.

It appears reasonable, therefore, to suggest that the variation of the shade may be directly due to the hygrometric state of the material. In attempting to verify this hypothesis, samples of woolen felt dyed with different coloring matters were taken and cut each into three parts. One lot was placed in a desiccator holding a vessel of concentrated sulphuric acid, that is, in a dry atmosphere, where the wool would have the moisture taken from it progressively at the ordinary temperature until completely dry. Another lot was placed in a desiccator holding a vessel of pure water, that is, in an atmosphere saturated with moisture, where the wool would absorb progressively, and without being heated or cooled, the maximum amount of water it is able to carry. The third lot was kept in the air of the room.

The results have confirmed the hypothesis advanced. In the dry atmosphere the colors became modified in the same manner as takes place by drying them in the dry-room. In the moist atmosphere the colors became modified to the same extent as a wet cold pattern. The experiments were repeated with a large number of the acid and chrome dyestuffs for wool, and in each instance the immediate cause of the alteration of the shade was the hygrometric state of the fiber.

Heat only intervenes as a moisture-removing agent. That the return to the original shade takes place slowly may be explained by the fact that time is required for dried wool to resume its normal hygrometric state. As has already been stated, many coloring matters are very sensitive to heat, some others are hardly affected at all, while others are most profoundly affected. One coloring matter may furnish a bluish green, which, on material in the moist condition, will appear to be quite green, and which passes to blue by desiccation.—*L'Industrie Textile*.

INCREASING THE RESISTANCE OF WOOL

Undyed wool is made more resistant to the action of atmospheric influences and light by treating it with compounds of the type used in leather tanning, such as chrome alum, chromium chloride, alum, aluminium sulphate, or their more or less basic salts. Loose wool or the finished material is impregnated with the cold salt solution, e. g., a bath containing two grams chrome alum and 0.2 grams soda per liter, piled for twelve hours, swung, and dried.—Ger. Pat. No. 299,772.

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY

PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL

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THE SILVER LINING

DESPITE the great lull in buying, there is no reason to suppose that the textile industries of the country are in any real danger of being overthrown; summing it all up it would appear that the situation, while distinctly unpleasant, and even serious if you will, is by no means desperate. Final reports of dividends are expected to show that some exceedingly large profits have been made during the past year, and keeping in mind the sound financial position of the great majority of our mills, very few doubts are entertained as to their ability to weather the slack period.

The question which seems to be bothering many just now is the question of time. It seems hardly likely that conditions will become much worse in the industry, in fact, it is practically impossible; reports of additional shutdowns or inaugurations of part-time schedules from some quarters are intermixed with reports of slight improvement in activity in others. This, as much as anything, indicates that the worst is already here.

It is a bitter pill for anyone who has been making much money in double-quick time to find himself suddenly confronted with the prospect of losing a part of his profits. There are few who will escape that fate, however, for despite the scramble to cut overhead costs to the last cent, they cannot be entirely eliminated even when a mill is standing idle, and in any case a period of enforced inactivity means a loss of business and earnings on capital.

It may be of interest to some to know that consumers in one part of New Jersey were recently publicly advised as follows: "Don't buy any clothing unless you see a 50 per cent reduction in cost; don't buy anyway, if you can possibly avoid it, until after the holidays; have your old clothes dyed, or patch them once more, if you must, but force the retailer to come down!"

It is the latter gentleman, as much as anyone, who holds the key to the situation. The public has pretty generally got through with its "orgy of buying," even those of ample means being more or less fired by the ambition to help break retail prices. The retailer must shoulder his share of the burden which is to come, and the labor organizations, having had things pretty much their own way for some time past, are also facing a period when their increases avail them nothing in the way of actual money at the end of the part-time week. All in all, there are some who are worse off than the mill men.

As has been pointed out by others, worse things can happen than an over-supply of manufactured material. If the retailers can be induced to make their peace with the public, the dearth of buying should not be prolonged to a real danger point. If the textile industries are experiencing the worst period of stagnation in their history, so have they just passed through one of the most prosperous ever recorded, and it is to be hoped and believed that an improvement will begin to manifest itself after the turn of the year. It is true that prices of manufactured textiles have flown higher than those in some other lines and, hence, that they have further to fall now that the readjustment period is in full operation, but, for that very reason, those who have had the inevitable in mind during the past year—and they are many—should be correspondingly better fortified to withstand the reaction.

CONGRESS RESUMES

THE Council of the League of Nations, meeting at Geneva, officially decided to permit the use of poison gas in warfare—probably because the members of the body realized that it would be used anyway. And upon the heels of this information comes the report of Brigadier-General Fries, chief of the Chemical Warfare Service of our own army, in which he recommends that the development of this branch of the service here be carried to a point "where it is impossible for any nation to go further." General Fries wisely bases this recommendation upon the truth that an enemy bent on aggression cannot be trusted to live up to any set rules for war. He might have added that a nation defending itself from attack will likewise, before succumbing, resort to any means, international courts notwithstanding, to destroy the attacker, and if it has not the means at hand it is, in popular parlance, simply "out of luck" and must take the consequences.

This report will be an excellent thing to bring to the attention of Congress, now in session after a vacation of six months, before someone starts a discussion over the proposed "Blue Laws" or other interesting but less immediate matters. The subject of poison gas is scarcely a pleasant one to contemplate, but, then, neither is the idea of slaying a human being pleasant to the man who thoughtfully provides himself with an "automatic" on learning that there is a great crime wave in his city. The

prediction that the warfare of the future is to be chemical warfare is borne out with a vengeance, and only a madman would deliberately counsel neglecting this important item of preparedness. Hence, the United States has wisely decided to continue the Chemical Warfare Service with sufficient funds and powers to develop its possibilities, not for aggression, but to make sure that if American men must ever again shoulder arms in defense of the liberty of their country, they will do so on an equal footing with any other nation so far as chemical warfare is concerned.

We learn that, as matters stand to-day, this country is in a position to manufacture and deliver on the field of battle more chemicals than any other nation or group of nations. During the past year there have been conducted experiments of great value in the production of new gas and chemical instruments of war, and the Service has effected a close liaison with chemists and chemical societies in civil life. And while a certain brand of pacifists may shudder to hear of such "barbarous" preparations, the real practical pacifists, who know best how to insure lasting peace, are pleased.

It is needless to state that the civilian chemists with whom the closest connections are being formed are those engaged in the coal-tar chemical industries, particularly the dye and intermediate industries. This publication has many times urged the advisability of co-operating with and fostering the work of the Chemical Warfare Service in every possible way, and it lies within the power of the dye manufacturing chemists to lend most potent aid. Due to a combination of fortunate circumstances, as well as American technical ability and originality, this country at the present moment leads the world in this respect, and as long as we occupy this position there will be no danger of attack from anybody. The efforts of William Randolph Hearst to foment trouble between the United States and Japan are generally recognized as being nothing more or less than the efforts of William Randolph Hearst, despite the tremendous influence wielded by this publisher. Nevertheless it is interesting to observe in the day's news a cable report from Tokyo telling of the successful test of a new poison gas shell of Japanese manufacture.

The Japanese long ago demonstrated their ability to keep pace with their neighbors in science, and they mean to move forward steadily. England, to cite another example, under the guidance of the far-seeing "terrible little Welshman," will also see to it that she is not behind, League or no League. Both of these are friendly powers, and what is more, as long as the United States is on equal terms or better, they will be careful to remain friendly. There is a lot of satisfaction in being magnanimous to inferiors—much more than in being at the possible mercy of superiors, who may not be so magnanimous as ourselves.

We have the nucleus. To develop it will require a certain type of trained mind, as well as much money. The minds will be developed and kept keen by the existence of a self-contained coal-tar chemical industry, which

will likewise pay for the maintenance of the owners of those minds during the peace times which their presence should cause to endure permanently. There was never a better simile applied to the situation than that which likened the coal-tar chemical industries to "a standing army which pays its own wages in time of peace."

Without the coal-tar industries the development of the Chemical Warfare Service would be far more expensive and, in the end, might even then fall short of requirements. Without proper protection we shall have no coal-tar chemical industries. There are more reasons why these industries are vitally necessary to the country if it is to keep pace with modern progress and compete in the markets of the world than can be enumerated on the fingers of both hands. Yet, if all the others be discarded, the militaristic one alone is sufficient. As the English have it, "there is only one argument"; beginning with that, one need go no further to seek justification for the Dye bill and its claim upon the textile interests and the nation at large for support, and that is why this reason is again brought to the fore upon this, the occasion of the resumption of Congressional activities.

DYE SUBSTITUTIONS

THERE is being discussed with ever increasing frequency in the trade a condition which is of considerable importance to manufacturers of dyestuffs—particularly the less powerful ones—who are trying to free the country from the fetters of foreign dependence, and to manufacturers of textiles, whose best interests in the long run are bound up with the ultimate achievement of that freedom. The condition is not a new one; its potentialities and possible occurrence were recognized many months ago and its prevention was discussed among dye producers. Only within the past season, however, it has begun to play a part in the affairs of the industry which is fast becoming too prominent to be ignored, and the belief is generally felt that it is on the increase.

The condition referred to is the growing tendency of expert dyers to mix certain of the reparation colors being brought into this country under license from the War Trade Board, through the friendly offices of the Textile Alliance, with other dyestuffs and, with the combinations thus effected, to replace American colors, thereby diminishing the demand for the latter.

Not all dyers are capable of handling their materials so as to accomplish this, but the majority of the "old school" not only can but do. It is part of their stock in trade; and in the days when all our dyes came from Germany and there were no gaps in the full range of colors, one of the prime qualifications of a master dyer was his ability to obtain a surprising number of shades by combination. But for this he needed some of the best products of the German dye makers and, therefore, since the war he has been greatly limited.

When the shipments of reparation colors, so long

delayed by the Rotterdam dock strike, at length began to make their appearance, however, they were hailed with delight for more reasons than one. Months before this the "old masters" had scanned the list and had sent in their orders, and when the colors reached the dyehouses they were soon bringing about some results not bargained for by those Senators who have been giving their support to the Dye bill. American colors, bought and paid for, here and there began to come back upon the market, to the great surprise of some dealers and the great annoyance of all—except consumers.

To take a single instance, Alizarin Blue Black B was selling in microscopic quantities, at one time during the war period in this country, for somewhere in the neighborhood of \$7.50 a pound. What could be obtained was eagerly sought after, but the number who sought in vain was in no way to be compared to the number who sought successfully. The former constituted an overwhelming majority. Then the Textile Alliance began to bring it into this country, six months' supply to a consignee, at \$1.95 a pound, and many firms were supplied in this way. Those who got some were immediately able to say to American color manufacturers: "Until further notice we shall require no more of your undoubtedly excellent Chrome Blacks, Chrome Blues, Acid Blacks or Acid Blues."

There one has a pretty wide range of colors which can be displaced from the dyer's scheme of things by the acquisition of a single color not as yet being made by Americans. The dyer himself and many others who may read these lines can doubtless sit down this minute and prepare a lengthy list of possible substitutions, the length of the list depending upon the author's knowledge and practical experience. And with the increasing number of types not made here expected from Germany under the licensing law, the list will grow.

The purpose of the licensing law is to act as follows: Let us say, for example, that the normal consumption of Alizarin Blue Black B in this country is 100 pounds per year. Since it is not manufactured here the Tariff Commission, or whatever body is ultimately designated to administer the law, permits the importation of Alizarin Blue Black B from Germany or other sources at the rate of 100 pounds per year in quantities providing a six months' supply at a time to each company using this dyestuff. Let us suppose that this condition persists for one year, at the expiration of which an American dye manufacturer notifies the authorities in Washington that he is able to produce Alizarin Blue Black B at the rate of fifty pounds per year. Determining that the manufacturer can really do this while maintaining a satisfactory quality and price, the Commission then proceeds to issue licenses for the importation of this color at the rate of only fifty pounds a year, thus keeping the consumers' quota at normal and assuring the

American manufacturer a market for his goods by eliminating foreign competition. If, later on, he increases his production to seventy-five pounds a year, or another manufacturer begins to produce twenty-five pounds a year, let us say, foreign makers are then limited to importations of only twenty-five pounds, and so on until the American industry is supplying all requirements, whatever they may be.

This is a brief outline of the purpose of the licensing law as provided for in the present Dye bill. According to many who favor it, however, there are two loopholes in even so well planned an instrument, and it is their further belief that it is impossible to frame a clause which would dispose of them. They consist of, first, the fact that there is no way of determining what should be a normal six months' supply for any dye user and, second, that there is no way of preventing the substitution of a number of imported German colors for American colors, thereby eventually reducing instead of increasing the number of types supplied at home. It is pointed out that a dye user desiring to make use of a German color "straight" can figure what his requirements are for six months, and then add on enough extra to take care of his plans for likewise using it, in combination, as a substitute for American colors. And if the resulting large demand is questioned by the administrators of the law, there is no way of disproving a statement to the effect that the purchasing company proposes to make a large run on that particular color.

Naturally enough, a clause could be included in the Dye bill making it unlawful to substitute any imported color for American colors; but the wisdom of doing such a thing need not even be discussed—it is too absurd. No legislative body would dare to pass such a measure, and if it did the group of administrators capable of enforcing it does not exist outside of fiction. This leaves the whole situation depending upon the answer to the question, Can such a practice be undertaken upon a large enough scale to make it the ultimate executioner of the American dye industry?

Certain manufacturers and dealers are to-day claiming that it can, and that because of its assured prevalence the industry is doomed to wither and dry up. It is stated by some that a complete embargo is the only means of preventing this; that they are to-day in an expiring business, and that if Germany is allowed to get even so much as a foot inside the door she will, by the means outlined above, force it to open wide.

That is the extreme view, and even its followers agree that an absolute embargo is out of the question. The REPORTER has, before this, taken the position that an absolute embargo is not necessary in order to create a dye industry here, but if that should ever prove to be the purchase price for an industry it is still not too great to pay, nor would it, we further believe, turn out to be a calamity from which there

could be no recovery. However, since it will not be needed, let us dismiss it for good and all.

To return to the question of substitutions, the argument is advanced by certain manufacturers that this practice leaves no incentive for Americans to proceed with research and experimentation looking to the manufacture of hitherto imported colors. They declare that the time which must elapse between the announcement of the production of a dye being supplied from without and the complete consumption of existing supplies—figuring this to be from six to eight months—leaves them unable to find a market, and hence obliged to keep the capital invested tied up without a chance to earn interest.

There is the crux of the matter. The larger manufacturer can afford to do this, but the smaller cannot. It is the smaller manufacturers who are declaring that the licensing law will not avail to save the industry from the Germans, although supporting it nevertheless.

It is to be hoped that no one will be gulled into believing that the American dye industry is doomed unless protected by an admittedly impossible embargo. When the small manufacturer or merchant talks thus he really means that his own business will feel the weight of the substitution practice, and not the American dye industry as a whole. There never was an industry yet in which the small manufacturer did not have harder sledding than the big one, but the small manufacturer has his uses and under the laws of the land there is little danger that even he will be wiped out *en masse*. The answer in the present case seems to be that not to him is to fall the triumph of the pioneer in adding new vat colors for the repertoire of the industry. It is the big companies, with their extensive research laboratories and superior staffs, that must break fresh ground in this as in other industries.

Within the past few months the Newport Company alone has announced the production, on a full commercial scale, of five new vat colors, and is now marketing these. We have recently seen an announcement of Anthraquinone to be made and sold here at a price of seventy-five cents a pounds, and this in itself should be a powerful stimulus for the manufacture of Alizarin colors at prices enabling them, under the licensing system, to legally exclude from our markets this class of competitors without working any hardship on consumers.

The question of substitution, it would seem, while undoubtedly interesting, is not in any sense of the word a real menace. The best indication of this is the fact that some of the smaller manufacturers have expressed wonder that big companies have not taken steps to prevent it. The answers are fairly obvious: (1) There is no way of preventing it, and (2) there is no need.

STANDARD METHODS OF DYE TESTING

By ELVIN H. KILLHEFFER

Vice-President, Newport Chemical Works, Inc.

PROFESSOR OLNEY'S article in the September issue on the subject of standard dye testing methods is of considerable interest, particularly in view of the fact that the expressions therein come from the head of a consuming mill as well as a very prominent teacher in the field of dyeing and textile chemistry. This shows openly evidenced interest in the subject from two new quarters.

To be sure, all users of dyes have always been very much interested in knowing the fastness of their colors to various destroying influences, but interest in standard methods is quite new, I think, from consumers.

Professor Olney is not entirely correct when he says that the work done in this direction by the foreign concerns was always from their own viewpoint without being particularly in the interest of the consumer. The foreign concerns did do a very great amount of work in connection with fastness and methods for determining the various kinds. The methods devised and often published by them were in almost all cases based on knowledge gained by their workers who went into mills to do practical work and they were certainly made as practical as the dye maker alone could make them by using the best information he had of the consumer's needs.

There was never devised any standard set of methods universally accepted and used for the precise reason, I think, that the manufacturers could not make such a scheme effective, no matter how desirable it would have been. While the Dyes Institute and every manufacturer in this country has devoted a great deal of time and thought to this subject, still the same reason will prevent any real accomplishment until consumers, manufacturers and schools get together.

In almost all cases except fastness to light it is not a terribly difficult task to devise methods which, I believe, would be satisfactory to everyone, and such a set of methods could be drawn up and submitted to some consumers' body or bodies, the Dyes Institute and the Textile Schools. Once agreed upon by all of these we would have real standard methods.

Fastness to light is of course more difficult, for, as we know, the sun's rays vary with the hours, season, etc., as well as with the place of exposure. Many artificial lights have been developed for making light tests, but up to the present I have not seen one which is really reliable as compared with sunlight.

My own thought is that the easiest way to get around the difficulty would be to first select a number of colors in each class representing several gradations of fastness and then all others could be standardized against these, for, as the light would vary, it would make no material difference for there would always be the comparison with the standard which itself would have a definitely established

and recognized fastness. This method would, of course, only apply to the testing of the dyes themselves but methods along similar lines could, I believe, be easily worked out to be applicable to combination shades of all kinds.

Naturally these are suggestions only and could be en-

larged upon and clarified. The first requisite is, however, in my opinion, as pointed out by Professor Olney, development of interest on the part of consumers—for only when adopted, used and recognized by them will methods be standard.

Fastness to Washing

A Report of Experiments Performed by L. Pelet Jolivet

Abstracted from the German

By BENEDICT C. HEYMAN

United Chemical & Color Company, New York

THE following report of experiments performed by the author should stimulate the attention of those dyers who have more than a mere interest in "turning hanks."

Very careful observations are here given showing the effect of basic and acid dyeings when treated with various reagents and the conclusions drawn from these observations can have wide application in their daily work; furthermore, the important concept of fastness to washing of basic and acid dyeings will then become more clear.

A hank of wool of 20 gr., weighed dry, was placed in each of several large flasks containing concentrated sulphuric acid, concentrated hydrochloric acid and a n/50 solution of sodium hydroxide. In each case the wool was allowed to remain for five days. The liquid was then decanted and measured. Five hundred cubic centimeters of distilled water was repeatedly added to each flask containing the wool. This was done in order to extract as well as possible by a great number of washings the reagents that had gone on to the wool. After each five days the liquid was drawn off and the amount of reagent gone into solution was determined as follows:

Original amount of H_2SO_4 used.....24.5 gr.
 H_2SO_4 left in solution.....19.52 gr.
 H_2SO_4 retained by the wool.....4.908 gr.

Washing	Volume of Decanted Liquid (c.c.)	H_2SO_4 Eliminated (gr.)
With cold distilled water—		
1.....	500	3.3148
2.....	500	0.4773
3.....	500	0.1651
4.....	495	0.0761
5.....	490	0.0603
6.....	477	0.0409
7.....	510	0.0374
With warm water—		
8.....	450	0.0216
9.....	565	0.0292
10.....	520	0.0208

11.....	485	0.0248
12.....	485	0.0189
13.....	495	0.0209
14.....	515	0.0222
15.....	515	0.0157

The same procedure as above was carried out with hydrochloric acid with similar results, cold distilled water being sufficient for entire process.

Original amount of HCl used.....18.25 gr.
HCl left in solution.....14.8394 gr.
HCl retained by the wool.....3.316 gr.

Washing	Volume of Decanted Liquid (c.c.)	HCl Eliminated (gr.)
1.....	500	2.4413
2.....	500	0.3963
3.....	500	0.1594
4.....	500	0.0946
5.....	490	0.0563
6.....	465	0.0350
7.....	500	0.0283
8.....	489	0.0157
9.....	500	0.0166
10.....	525	0.0177
11.....	520	0.0182
12.....	470	0.0073
13.....	495	0.0117
14.....	505	0.0044
15.....	520	0.0025

In the case of caustic soda n/50 solution 0.4 gr. were used:

NaOH left in solution.....141 gr.
NaOH retained by the wool.....212 gr.

Nearly all the caustic soda was eliminated after the second washing in 500 c.c. of water. This differed greatly from the washings of sulphuric and hydrochloric acids; since in their case, fifteen washings were necessary before a more or less complete elimination of reagent from the wool took place.

The above samples of wool as well as wool treated with dilute solutions of these reagents and also a sample of untreated wool were dyed with 2 per cent Methylene Blue and 1 per cent Ponceau 6 R. The following observations were made:

	Absorbed Methylene Blue (mg.)	Absorbed Ponceau 6R (mg.)
HCl	24.8	42.6
HCl n/10	25.9	40.0
HCl n/100	20.2	42.6
H ₂ SO ₄	15.4	188.0
H ₂ SO ₄ n/10	14.9	116.3
H ₂ SO ₄ n/100	15.8	48.4
NaOH n/50	79.0	48.4
H ₂ O	15.4	98.8

These results, in combination with those obtained from the reagent observation tests, confirm the fact that wool treated with sulphuric acid and washed, affects the wool more than if treated with hydrochloric acid. The sulphuric acid is much more difficult to separate.

The above dyeings were submitted to the following tests:

Each dyeing, after being taken out of bath, was dipped in a beaker of 200 c.c. of distilled water. Part of the dye washed off. The amount of washed off dyestuff was determined as follows:

METHYLENE BLUE

Wool treated with—	Absorbed Dyestuff (mg.)	Washed-off Dyestuff (mg.)	Residue Evaporated at 100° in Platinum Dish (mg.)	Ashes of Residue (mg.)
H ₂ SO ₄	15.4	9.0	553.5	153.5
H ₂ SO ₄ n/100	15.8	9.0	335.0	147.5
HCl	24.8	15.2	261.0	135.5
HCl n/100	20.2	13.5	307.0	165.5
NaOH n/50	79.0	31.6	339.5	175.0

PONCEAU 6R

H ₂ SO ₄	188.0	Traces	373.5	143.0
H ₂ SO ₄ n/100	48.4	3.88	276.5	137.0
HCl	42.6	9.7	192.5	56.0
HCl n/100	42.6	11.64	308.5	99.0
NaOH n/50	48.4	9.7	152.0	55.5
NaOH n/100	36.8	17.46	255.5	96.0

The results of this experiment confirm what we already know, i.e., that acid dyed wool does not wash off in a sulphuric acid bath, whereas other dyes wash off in more or less perceptible amounts.

The dyeings were then worked in a Soxhlet apparatus until dyeings were stripped. Those dyeings which had been treated with caustic soda showed about one-half as much resistance as the dyeings that had been treated with sulphuric acid. The extraction in the Soxhlet apparatus showed that what the water took away was not only dyestuff, but also organic matter which belonged to the wool. This was proven by the fact that when the water was evaporated there was left a residue which had a

greater weight than the original amount of absorbed dyestuff. The ash of this residue was analyzed and was found to contain mineral elements, confirming the fact that something more than dyestuff was taken from the wool. The organic matter was found to be in direct proportion with the amount of fixed dyestuff.

A group of textile samples which had been dyed ten years before were compared with new dyeings to determine their relative fastness against washing. The Soxhlet apparatus was used. No perceptible difference in fastness to washing was shown between the old and new dyeings. Comparative tests of fastness against soaping also gave no perceptible differences between the old and new dyeings. The following table is arranged in the order of fastness of the dyestuffs used:

	Hrs. in Soxhlet	— Dyeings Discolored — Washing in Soxhlet	Soaping
Acid Violet 6B	12	Very slight	Slight
Fast Silk Pink	10	Slight	Slight
Rhodamine B	8	Disc. 80%	Disc. 80%
Methylene Blue	8	Disc. ch. to lt. blue	....
Ponceau 6R	6	Discolored	....
Basic Violet 4R	6	Disc. 50%	Disc. 80%
Rheonin	8	Disc. 80%	Disc. 90%
Safranin	7	Disc. 50%	Complete
Bismarck Brown	7	Disc. 70%	Disc. 90%

GARMENT DYERS AND DYEING

By WALTER J. BAILEY

Bayburn Cleansing Shop, Cambridge, Mass.

THE garment cleanser and dyer of the present time has received little notice from the textile world. He has been, in the majority of cases, a man of little education and has run a business in a slack and rutty manner. This condition is fast changing and in the last five years the cleansing and dyeing industry has become an important business, and the service of the cleanser has become one of the essentials of daily life. Due to the high price of cloths, the dyeing establishments have received more garments to be cleansed and dyed than ever before. People have sent in their clothing in every conceivable condition with the hope of getting another season's wear or perhaps something which has the appearance of a new garment for the cost of five or six dollars.

It may be interesting to know a little in detail the problems of the garment dyer as compared with the mill dyer, and one can readily see that while the procedure is similar, the conditions which have to be contended with are different and oftentimes aggravating.

GARMENTS RECEIVED IN BAD CONDITION

The garments come to the dyehouse just as they are taken from the wearer, with a belt loose or a cuff and collar only basted on. These small loose parts must be properly attached so that they will not be lost in the dye vat, or left entirely, causing much dissatisfaction and

trouble. The first place to start the work going right, preliminary to even sorting out the different colors, is in the marking or tagging; getting the garment intact and giving it the proper identification. After this first operation is complete and properly done, it next becomes necessary to sort and overhaul.

OVERHAULING AND CLEANING

This part of the work falls on a man who knows the dyeing of garments thoroughly. It is his task to get the different materials in the right lot and with the proper colors. At this point the condition of the clothes is noted very carefully for wear, soil, fades, and sunburns.

First is wear. In many cases a garment shows wear so badly that it is doubtful if the owner will consider it worth the price of dyeing and leaves for that reason old, wornout garments for the dyehouse to dispose of as best they can. Therefore if there is any doubt of its being worth the price of dyeing it is best to notify the customer beforehand.

Second is soil. In all cases the garments to be dyed have been worn and are soiled. Some are worse than others and have many different stains, the nature of which must be considered before dyeing. Oil and paint stains, for example, must be removed or the dye will not penetrate the fiber which is waterproofed by the stains. The stains in particular must be kept separate and removed by naphtha cleansing. Paint is then removed by the aid of tetra-chlor-ethane, which seems to have the best solvent power for old "dried on" paint. Ordinary grease will be entirely eliminated by the naphtha cleansing process.

Garments which are generally soiled, but free from paint and an excessive amount of grease, are prepared for the dyeing by being thoroughly scoured with soap and water, using ammonia for the alkali to aid in the cleansing. It must be remembered that the result of the finished garment depends upon the care of every operation, especially that of scouring, where the wool is soft and may develop wrinkles which will never be taken out. The scouring must be done in a temperature not over 120 degrees Fahrenheit, and thorough rinsing must follow, after which the garments are ready for the dyeing proper.

Third are fades and sunburns. Fades and sunburns are trouble makers for the garment dyer on wool. Faded and sunburned parts of the wool act the same as chlorinizing the wool. These parts which have been exposed to the sun have a greater affinity for dyes than those which have been covered. You can easily get the shoulders of a coat very dark, while under the collar is five or six shades lighter and down the back is still a different shade. The appearance of the coat is that of neglect on the part of the dyer. In these extreme cases it is always advisable to get an order to dye black, which has the power of covering everything within reason. In many cases the dyer can foresee this condition, and trou-

ble is avoided by notifying the customer to the effect that the garment will have to be dyed dark or even black. There are also differences in dyestuffs even of the same shade in the covering power on fades. Therefore it is necessary for the dyer having this in view to make a careful selection of his dyestuffs regardless of price.

THE DYEING OPERATION

After all this preliminary inspection and sorting has been completed, the colors being sorted in lots and lots cleaned as the conditions demand, they are ready for the dye vat. The dye vat is prepared with 10 to 15 per cent of Glauber salt in the case of dark shades, for standard, such as black, navy blue, seal brown, dark green, and dark red. Where any quantity of dyeing is done it is more economical to keep standing vats of the above colors and strengthen with from two to three per cent for each dyeing. Temperature plays an important part, as you will remember we have to deal with cotton, wool and silk. It is always well to get the dark shade desired on the cotton first and this is done by keeping the temperature below a boil for at least one-half hour. This not only dyes the cotton but helps to penetrate the seams and folds, and prevents the dye from going on the surface or knap of the wool. After the proper shade has been acquired bring the liquid to a boil and keep at a boil for twenty minutes longer, after which the garment should be dyed the proper depth of shade.

In garment dyeing the less boiling that is required the more beneficial it is for the shape of the garment. When dyeing a man's suit coat, for example, we have the facing and shoulder pads which must be kept in shape and not boiled so long that the firmness of the material seems to have been boiled out leaving what is called a "ragged dyed job." After completing the dyeing which has been handled properly, the whole lot can be spoiled in the rinsing which is just as important for the final result as any other operation.

COOLING AND DYEING

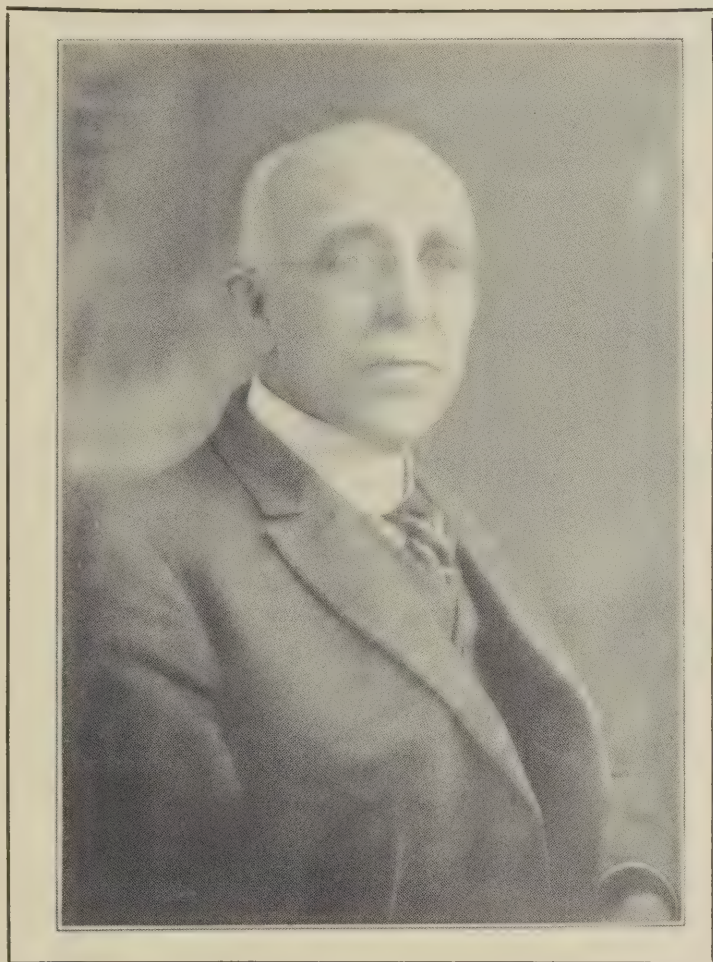
Proper cooling must be very carefully done or heat wrinkles will result. The garments must be cooled and freed from wrinkles before they are allowed to lie—gradually starting with 180 degrees Fahrenheit, and later taken out for extracting absolutely cold even on the inside of the heaviest seam or fold. A slight sizing, if beneficial, is given at this time. Then lay in the extractor as smooth as possible and do not extract too hard.

After extracting, the garments are taken out and shaken free from wrinkles before hanging up to dry. When possible hang garments out of doors as the best drying conditions are obtained from the wind which tends further to straighten out the wrinkles.

Overhauling after drying is the next operation. Here it is necessary to make sure the fades are covered and even dyeing has been obtained before spending time and money on the pressing and reshaping of the garment.

MEN OF MARK

in the Dyestuff Field



William P. Atwood
Chief Chemist
Massachusetts Cotton Mills
Lowell, Mass.

WILLIAM P. ATWOOD was born in Orrington, Me., October 27, 1853, and in 1864 removed to Lowell, Mass., where he still resides. His early education was received in the grade and high schools of the latter city, and in 1872 he entered the Massachusetts Institute of Technology, from which institution he was graduated in 1876, in the course of chemistry, with the degree of S.B.

Immediately after graduation he entered the employ of the Hamilton Print Works, of Lowell, as chemist and remained with them until their printing interests were sold to The Pacific Mills in 1909. In 1910 he was appointed chemist to the Massachusetts Cotton Mills at Lowell, which position he still holds.

During the period of his residence in Lowell he taught chemistry in the Lowell Evening High School for two years and has done considerable work of a consulting nature for other textile manufacturers. Mr. Atwood's experience in the coloring of cotton textiles and related problems has been extremely wide, and in a recent letter he says of his experiences: "From 1876 to the present I have witnessed the development of the modern color industry and feel that I have lived at a most interesting period of the world's history."

A friend of many years pays the following tribute to Mr. Atwood: "I have found him to be a scientific enthusiast, an exceptionally clear thinker, a master of the minutest details of his professional work, an indefatigable worker, and one always ready to lend a sympathetic ear and advise with his brother chemists."

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

L. B. D.—Question—I am enclosing herewith a swatch of dyed goods. Can you tell me definitely whether this effect is obtained by printing or is it obtained by a special bowl on a paddler? The effect is new and any suggestion which you may be able to make will be welcomed.

Answer—We have submitted your sample to several experts and no two of them seem to agree except as to the fact that the effect produced is new in their experience. One opinion is as follows:

"As nearly as I can judge, this effect was produced by printing both sides in a printing machine specially constructed for that purpose—such a machine as is sold by Rice & Falls, Worcester, Mass."

Another authority expresses the belief that the effect is not printed at all but produced by a slop padding process, similar to the so-called chambray, which is produced by running the cloth through a cold solution of dyestuff in a padding machine and then drying without washing. Under the circumstances we believe that all you can do is to try both methods and note the effects produced.

W. D. A.—Question—We notice in your November 15 issue the last item under "Dye-a-Grams" states that one dyestuff house has published formulas for matching the shades of the Standard Color Card. Could you kindly inform us what house this happens to be?

Answer—The formulas referred to are prepared and distributed by the National Aniline & Chemical Company, Inc.

L. N. T.—Question—We have just received a shipment from Persia of the following commodities: Persian Berries, Gall Nuts, Gum Tragacanth, Poppy Seed. We believe that these products have certain uses in the textile industry. Will you please advise us if we are correct and, if so, what their uses are?

Answer—Persian berry extract has been and is used extensively in calico printing, gum tragacanth is used very extensively as a thickener in calico printing, gall nuts are used as a raw material in the manufacture of various tannin and tannic acid products which are in turn used in calico printing. So far as we know, poppy seeds serve no textile purpose.

S. M. W. Co.—Question—Will you please advise us the best method for making very light baby colors in blue, pink, tan, etc? Is it your idea that the best way to make these colors is by blending or dyeing these very light shades? All of our work is on all wool.

Answer—The best method to produce very delicate shades resolves itself into a question as to whether you have the proper facilities and also what grade of wool you are using. In most instances where the ordinary quality of wool is used the very delicate shades are best arrived at through blending. That is, darker shades are first dyed and then mixed or carded with white wool to produce the desired shade. However, if a good quality wool is to be dyed and the proper dyeing facilities are available, very good results can be obtained with level dyeing colors when the shades are dyed direct. Unless you have special equipment, we believe that you will get better results by blending than by dyeing.

S. G. Co.—Question—We enclose a sample of gray dyestuff which we would like to have you analyze for us and advise us what combination of colors you think we can use to mix this color for ourselves.

Answer—Our analysis showed that the mixture submitted contained approximately 70 per cent of a direct blue, 12 per cent of a direct yellow and 18 per cent of a direct red. In order to verify these figures we submitted a portion of your sample to a dyestuff concern which specializes in direct colors and asked them to make a dyeing thereof and then attempt to match it with their own colors and let us know the amounts of each used. Their reply is as follows:

"We hand you herewith an 8-ounce dyeing on cotton yarn of the sample of gray submitted by you and also a dyeing of the following combination, which is a fairly close match.

35/8 ozs. Direct Blue 3B
5/8 ozs. Direct Yellow G
7/8 ozs. Direct Scarlet 6BX

"The quantities of color mentioned are for 100 pounds of material."

We have forwarded you the two dyeings under separate cover.

R. D. Co.—Question—Can you advise us as to who is manufacturing Cloth Red in the United States?

Answer—Cloth Red is manufactured in the United States, to our knowledge, by three concerns: The National Aniline & Chemical Company, Inc., the Grasselli Chemical Company, and the Cincinnati Chemical Works, Inc. Selling agents of the latter concern are Geigy Company, Inc., 89 Barclay Street, New York City, and Sandoz Chemical Works, Inc., 238 Water Street, New York City.

K. L. R. Co.—Question—Can you refer us to a method of determining the amount of free sodium sulphide in a sulphur dye bath? We would like a rapid test that would serve to guide us in making additions of further amounts of sulphide in a standing bath. Just now we wish to apply it to blacks and blues but expect to use other colors a little later.

We have tried the method outlined in *Journal of Society of Dyers and Colourists*, Vol. 33, page 145, but could not get consistent results using a straight sulphide solution alone. We are looking up a method published previously in the same journal but of which we have not a copy. If you have any information on these or any other methods we will be very much interested.

Answer—For straight sodium sulphide solutions probably the best method is to exactly neutralize the solution with acetic acid (phenolphthalein indicator) and then titrate with a standard solution of crystallized zinc sulphate. Cadmium sulphate is used on a spot plate or paper as an outside indicator.

In the case of a dye bath, we should think that if one acidified it with acetic acid and boiled, the H_2S could be evolved and then absorbed in an $NaOH$ solution. This solution would then be titrated as above. In some dye baths the titration might be carried out directly, but in most the distillation would be better.

We have no data on such a method but see no reason why it should not be satisfactory. The organically combined sulphur of the dye should not be evolved by the acetic acid while all the sulphur as sulphide should be evolved. Air free water should be used to prevent oxidation.

Another suggestion which we have received from a practical dyestuff chemist is as follows:

The reactions of the sulphur dye bath are very complicated and as there is no exact knowledge of the actual composition of a bath that has been run for a time, ordinary chemical tests will give misleading results. First, the sulphide used is a mixture of normal sulphide and polysulphide and the oxidation products of it may contain free sulphur, sulphates, sulphites, hyposulphites, and a whole series of thionates. Then the extractive matters of the cotton and caustic together form a colloidal reducing agent which reduces the dye and gives rise to still more complicated bodies. Briefly, theory is helpless and we have to fall back on the practical question of whether all the dye is reduced and in solution and how much more sulphide is needed to bring about the desired results.

This can be determined by dropping a spot on white filter paper and noting the spread of the ring, whether a spot of sediment is left and whether the color is as strong on the back of the paper as on the face. If not, more sulphide should be added until the results satisfy. The practical dyer can tell by the appearance of the rinse water whether the amount of sulphide is correct, but I do not believe it has ever been worked out by a chemist.

Review of Recent Literature

Application of Dyestuffs; J. Merritt Matthews, Ph.D.; 768 pages, 6x9; John Wiley & Sons; \$10.

This is a comprehensive and more extended development of the author's earlier book entitled "Laboratory Manual of Dyeing and Textile Chemistry." The treatment has been so broadened in scope that the book now appeals to the interest of all those concerned in the application of dyestuffs. A brief discussion of the use of dyes in lines of industry other than the field of textiles is also included. An experimental outline is distributed through the different chapters, serving as a laboratory guide for the teacher and student, and also furnishing concrete examples to the general reader.

The subheads under which text matter is grouped are as follows: Introduction; Chemical Study of the Fibers; Scouring the Textile Fibers; Bleaching of Wool and Silk; Bleaching of Cotton; Classification of Dyes; Application of Acid Dyes to Wool; Application of Acid Dyes to Silk, Cotton, etc.; Representative Acid Dyes; Application of Basic Dyes; Basic Dyes on Cotton. Principal Basic Dyes; Application of Substantive Dyes on Cotton; Substantive Dyes on Wool and Silk; Developed Dyes on Cotton and Silk; Application of Mordant Dyes; Sulphur Dyes; The Vat Dyes; Aniline Black; Use of Logwood in Dyeing; Minor Natural Dyes; The Mineral Dyestuffs; Dyeing of Fabrics Containing Mixed Fibers; Application of Dyes to Minor Fibers; Linen and Ramie, Hemp, Jute, and Artificial Silk; Theory of Dyeing; Testing the Fastness of Colors; Application of Dyes to Various Materials; Application of Dyestuffs in the Preparation of Lakes, Inks, etc.; Testing of Dyestuffs; Miscellaneous Tests in Dyeing; Chemical Reactions of Dyestuffs; Analysis of Textile Fabrics; Useful Data for Dyers and Textile Chemists.

"Improvement of Working Conditions by Mechanical Ventilation with Special Reference to Dyework and Chemical Works." J. E. Brierly, *Journal of the Society of Dyers and Colourists* 36, p. 233-7 (1920).

Methods of removing steam from bleacheries and dye-houses, chiefly by the system of steam absorption is described. This consists in blowing warm dry air into the rooms where it almost immediately absorbs the steam. In some cases it is necessary to extract the moist air by fans. The article is accompanied by 12 excellent photographs of the system in actual operation in various plants. The discussion following the article brings out many points in regard to dyehouse ventilation. Those who have experienced difficulty because of the collection of steam in their dyehouse or bleachery will find many beneficial suggestions contained in this article.

AMERICAN DYESTUFF REPORTER

MONTHLY TECHNICAL SECTIONS

VOLUME 8

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AMERICAN DYE STUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 8, NO. 1
JAN. 3, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

Professor Louis A. Olney offers the initial instalment of an exhaustive treatise on "Operations Preliminary to Dyeing Wool Fiber." The present instalment is concerned with wool scouring.

"The Technology of Chrome-Tanned Upper Leather" is discussed by William C. Jackson in a two-part article, the first section of which appears herein.

Frederic Dannerth, Ph.D., in collaboration with Kurt Gebhard, Ph.D., presents an elaborate paper on "Laboratory Experiments in Rendering Dyes on Textiles Fast to Sunlight." The second section of this paper will appear in "The Reporter's" Technical Supplement for February.

"Laboratory Methods of Dyeing and Testing Cotton Dyestuffs" is the title of an interesting paper by P. F. Estey, of the Bradford Dyeing Association.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 8, No. 1

NEW YORK, JANUARY 3, 1921

Section 2

Operations Preliminary to Dyeing Wool Fiber

Part I—Wool Scouring

A Discussion of the Treatments of Wool Fiber Previous to Dyeing, Either in the Raw, Spun or Woven State, Which May Influence the Results Obtained During the Dyeing Process

By LOUIS A. OLNEY

ALL textile fibers require certain preliminary treatments of a more or less chemical nature before they are in a suitable condition for dyeing and finishing. Chief among these treatments are: "Boiling out" and bleaching, in the case of cotton and linen; scouring or some form of degreasing, in the case of wool; and degumming or "boiling off," in the case of silk. Depending upon the character of the fiber and the uses to which it is to be put, these preliminary operations may be given in the raw or loose state, which is without exception the case for wool; in the form of yarn, as is ordinarily the case with silk; and in the form of cloth, as is most frequently the case with cotton. Owing to the entire difference between the chemical composition of the animal and vegetable fibers, and also to a great extent between the two important animal fibers wool and silk, these preliminary processes are for the most part entirely different, and therefore cannot be discussed collectively. The present discussion will be confined entirely to wool.

RAW WOOL

Raw wool fiber as clipped from sheep is so heavily laden with impurities, most of which are of a greasy, sticky or gritty nature, that it is impracticable to proceed with any portion of the actual manufacturing process until these impurities have been removed.

With wool, therefore, the important preliminary treatment must be given to the fiber while it is in the raw and consequently loose state, regardless of the kind of yarn or cloth into which it is to be manufactured. In addition to this cleansing of the raw wool it is in some cases necessary to give woolen and worsted yarn, particularly the latter, a scouring, and almost invariably woolen and worsted cloth is scoured. These latter treatments are necessitated through secondary causes rather than the presence of natural accompanying substances, and will be discussed under the respective headings of yarn and cloth scouring. Woolen and worsted yarn and cloth are sometimes bleached, and loose wool and cloth may be subjected to the carbonization process in order to remove burrs and other vegetable matter. These processes are given after the scouring but previous to the dyeing, and therefore come under the general heading of "Operations Preliminary to Dyeing."

A number of the so-called wet finishing processes—e. g., fulling, crabbing, steaming and decatizing—are most frequently applied previous to dyeing and are of the utmost importance to the dyer and the success of his work, and will therefore be briefly discussed.

The processes to be considered in this article therefore include all treatments given to wool previous to dyeing, either in the raw, spun or woven state, which involve the use of chemicals¹ or which may

¹ Certain of these processes—i. e., crabbing, steaming and decatizing—involve only the use of water, which, although not a chemical according to com-

mon interpretation, is in the strictest sense the most valuable of all chemicals, a fact which is frequently overlooked owing to its abundance.

influence the results obtained during the dyeing process. They may be enumerated as follows:

Scouring or washing of—

Loose wool,
Yarn,
Cloth.

Extraction process for cleansing or degreasing of wool.

Carbonization process.

Bleaching of woolen yarn and cloth.

Wet finishing processes—

Fulling,
Crabbing,
Steaming,
Decatizing.

COMPOSITION AND ACCOMPANYING SUBSTANCES OF RAW WOOL

In order that a clear concept of the necessity for these preliminary treatments of wool may be maintained during our study, certain important facts concerning the composition and accompanying substances of wool will be reviewed.

Actual or cleansed wool fiber constitutes only from 25 to 70 per cent of raw wool as it comes from the sheep's back, the remainder being natural and foreign accompanying substances.

The wide variation in the accompanying substances of raw wool is often due to the fact that sheep are sometimes washed with more or less care before they are shorn. In this case the wool is known commercially as "washed wool"²; but when no attempt is made to cleanse the wool upon the sheep before shearing, it is known as "unwashed wool" or "wool in the grease."

In general the quantity of impurities carried by wool in the grease will average somewhere between 50 and 65 per cent, fine wools usually carrying a much higher percentage than coarse wools. These accompanying substances act fundamentally as a protection to the sheep from extreme climatic conditions, but incidentally serve as a preservative for the wool fiber.

The accompanying substance of wool fiber may be classified under three general headings:

- | | |
|--------------------------------|--------------------------|
| 1. Suint, or wool perspiration | } Wool yolk ³ |
| 2. Wool grease, or wool fat... | |
| 3. Mechanical impurities..... | |

The suint includes all substances accompanying wool fiber which are soluble in moderately warm water. It consists very largely of the dried sweat of the sheep and is commonly spoken of technically as "wool perspiration." Chemically it is composed chiefly of the potassium salts of organic acids of the aliphatic series, particularly stearic and oleic, with smaller amounts of the potassium and ammonium salts of volatile organic acids, such as acetic, propionic and valeric, and of such inorganic acids as hydrochloric, phosphoric and sulphuric.

The wool grease or wool fat includes the portion of the accompanying substances that is insoluble in water but readily soluble in such organic solvents as petroleum naphtha, benzene, ether and carbon bisulphide. It consists of a mixture of ethereal salts of various fatty acids with the higher solid alcohols cholesterol ($C_{26}H_{43}OH$) and its isomer, known as ischolesterol, accompanied by these alcohols in the free state. Chevreul, who made extensive investigations of wool grease, recognized three principal ingredients—stearerin (wool suint), a solid fat, at ordinary temperatures; elairerin (wool oil), which melts at 60 deg. Fahr.; and lanolin, which is a mixture of free cholesterol and ischolesterol. The percentage of free lanolin present is comparatively small, but considerable quantities are obtained through the decomposition of the fatty and oily constituents of wool grease. Wool grease varies greatly in color. When highly purified it is almost white, but in the natural state varies from yellow through orange to brown. Its physical state varies from a solid waxy consistency to an almost fluid condition, depending chiefly upon climate and food.

Special emphasis should be given to the fact that the fats and oils present in wool grease are not glycerides, since this has an important bearing upon the whole process of wool scouring. Glycerides, which constitute most of the common fats, are readily saponified by treatment with mild alkalis; but wool grease, on the other hand, is only partly saponified, even by boiling with caustic soda solution. Wool grease does, however, emulsify quite readily with warm alkaline soap solutions, and dependence has to be placed upon this action rather than saponification during their removal from wool.

The mechanical impurities consist chiefly of insoluble mineral matter, such as sand, clay and soil, and vegetable matter, such as burrs, and straw, particles of which are held mechanically to the wool by

² The term "washed wool" should not be confused with the terms "scoured wool" or "degreased wool," for the ordinary washing process removes but a small portion of the total impurities and but little of the grease.

³ The term "yolk" when applied in this connection

should refer to the combined suint and wool grease. Confusion frequently arises through the fact that the term "yolk" has been used to designate the suint alone, and sometimes the wool grease alone. It is perhaps well not to use the term at all, but when used it should always refer to combined rather than the individual constituents mentioned above.

the adhesive nature of suint and wool grease. The amount present varies greatly, depending upon local conditions and the care with which the sheep were raised, and although often less than 10 per cent may run as high as 30 per cent. Its nature depends largely upon the character of soil upon which the sheep have grazed. Chalk dust from limestone districts often imparts a harshness and perceptibly rough feel to the wool, and may necessitate special attention during the scouring process.

The accompanying substances of wool may vary decidedly in their resistance to scouring, some wools being scoured much more readily than others. Australian wools in general are scoured more easily than American wools.

OBJECTS OF AND CONDITIONS UNDER WHICH THE WOOL-SCOURING PROCESS IS CARRIED OUT

The previously described natural and foreign accompanying substances would, if not thoroughly removed from the wool, seriously interfere with the earlier steps in the manufacturing process, and later in dyeing and finishing, preventing the proper fixation of mordants and coloring matters. The objects of wool scouring and cleansing, therefore, are to facilitate the manufacturing processes, particularly carding and spinning, and, whether applied to loose wool, yarn or cloth, to present the fiber to different dyeing and finishing processes in as clean a condition as possible in order that level, clear and permanent dyeings, as well as a satisfactory finish and feel, may be obtained upon the final product.

The operation of scouring follows that of sorting, and in most cases is carried out by the manufacturer, although small concerns, and sometimes larger ones in special cases, send their wool to some establishment making a business of sorting and scouring, or at times may buy wool already sorted and scoured.

In mills of any size enough wool is used to necessitate a special wool scourer, and the dyer is relieved of this responsibility; but nevertheless it is essential that the thoroughly trained dyer should understand the chemistry and fundamental principles of the process of wool scouring, because such a knowledge might aid him in detecting unsatisfactory results in dyeing that may arise from careless or improper scouring which might otherwise be accredited to improper dyeing. Furthermore, he might at any time be called

upon either temporarily or permanently to take charge of the scouring.

THEORY OF WOOL SCOURING

The suint or wool perspiration is soluble in water; and the wool grease, although insoluble in water, readily forms an emulsion with an alkaline soap solution, and may be to a very limited extent saponified by mild alkalies. The mechanical impurities and dirt, with the exception of burrs⁴ and similar vegetable matter, are simply held to the wool through the stickiness or adhesive nature of the combined suint and wool grease.

From a theoretical point of view, therefore, the process of wool scouring is comparatively simple, for if we first wash the wool in warm water we remove the suint, and if we follow this with a scouring in a warm, mildly alkaline soap solution we remove the wool grease. A final rinsing in pure water will then wash away the excess of soap and also the remaining mineral matter and dirt which were released as the suint and wool grease were removed.

A similar result would, of course, be obtained by introducing the wool directly into the alkaline soap scouring bath without the preliminary treatment with water, thus removing both suint and wool grease at the same time. Both of these methods are applied practically and are known as emulsive wool-scouring processes.

The actual process of wool scouring is not so simple, however, for many points of importance arise in connection with the scouring of wool in the mill. The cost of the process has to be considered as well as the condition in which the wool is left. The quality of the water at hand is also of vital importance, and the utilization or disposal of the spent scouring liquor often becomes a problem of considerable moment.⁵

The extraction or solution process of cleansing wool by the use of such volatile liquids as naphtha, carbon bisulphide, etc., differs both in theory and practice from the emulsion process which we are now considering, and will be described as a special subject.

(To be continued.)

⁴ Burrs cling to wool fiber with great tenacity and are not at all removed by a wool-scouring process. In fact, certain types of burrs, such as the *Medicago* (*Leguminosæ*), which consist of a tightly coiled stem carrying many hooked spines, resist the energetic action of such machines as burr crushers and pickers, and can only be removed by the carbonization process, which destroys them through chemical action.

⁵ The consideration of spent scouring liquor is important from two quite different points of view—first, because of the valuable fatty matter, both from soap and wool grease, and the considerable quantity of potash compounds which it contains; and, secondly, because in many places it may be declared a nuisance and must be purified before being allowed to enter the river or sewer.

Technology of Chrome-Tanned Upper Leather

Part I

A Resume of the Effects of War on the Tanning Industry, Leading Up to the Conditions Now Existent in the Upper Leather Tanneries—Troubles Encountered in the Various Departments and Helpful Suggestions for Their Solution and Avoidance—General Outline of the Processes Used

By WILLIAM CLARK JACKSON

Colorist with J. S. Barnet & Sons, Inc., Lynn, Mass.

WITH the advent of war came the demand for leather of all descriptions—the vast armies and navies of the Allies had to be equipped with shoes and leather clothing, the horses and mules with harness, and in fact almost every available scrap of leather was put to some serviceable use, with the result that everything was cleaned up and the tanner became lax in his methods, knowing that his goods would sell in the ever-rising market.

DYESTUFF SITUATION

The dyestuff situation became acute and our supply was suddenly cut off. We overcame the difficulty by approximately matching our shades with the proper combinations of wood colors, such as fustic, sumac, hypernic, cutch and logwood, toning them up with bichromate of soda, titanium and iron salts. Even this procedure did not give the rich, full tone of the aniline dyestuffs: still it gave the flesh a fairly good appearance, and the grain was snuffed and finished with a heavy application of the so-called pigment finish, which not only produced a very even shade but covered a multitude of imperfections. The color being fixed mechanically, was not fast to rubbing and water; nor did the leather display the character and individuality of the pre-war product. Still, within certain limits the pigment finishes have helped to make leather better.

In a miraculously short period our color chemists developed the American dyestuff industry, practically from its birth, and nursed it through its infancy, until now it is self-supporting. Not only is it supplying practically all the American trade, but it is exporting large quantities of dyestuffs. These American colors compared with the German dyes, type for type, are not only identical chemically but in many cases are superior in brilliancy, strength and fastness to light. Gradually the tanner has come to depend more and more on aniline dyes for his color, and uses only a light coating of pigment to help even up his shades.

To-day, in this period of reconstruction, conditions in the leather market are the reverse of those during the war. Tanners as a rule are heavily stocked with the lower grades of leather, due to the lavishness of

the people, who, since the cessation of hostilities, have demanded nothing but the best in shoes. The people are now beginning to exercise more thrift and are refusing to pay the high prices asked. The shoe manufacturers in their endeavor to lower costs have refused to meet all the demands of the labor unions, with the result that practically a whole season's run has been lost. This has had its effect on the leather manufacturer, in that the tanneries of the country are now practically at a standstill. The leather export business is very poor, due to the rates of exchange, and the American tanner is beginning to meet foreign competition in his own home markets. These various conditions appear to show that the tanner is now entering a period of the keenest competition in which he must exercise all his ingenuity and fortitude in a supreme effort to produce the very best product possible from the stock on which he is working.

PRECAUTIONARY MEASURES

To obtain this result every little detail of the process must be watched to detect any deviation or error. All machines should be thoroughly overhauled and cleaned up. If the water supply comes from wells or tanks, the whole system should be cleaned out. All drums should be inspected for nails, which might scratch the stock; leaky doors or gudgeons, which are sure to make a variation in the colors, due to the loss of liquors.

Under the present state of affairs the writer feels that possibly an explanation of the various steps used in the manufacturing of chrome-tanned upper leather may be of benefit. Many of these steps involve principles of chemistry, many are purely mechanical; but unless we understand why we do these things we find ourselves in trouble and have our shop filled with stock which is not in as good a condition as it might have been had we understood a little more clearly the underlying principles of the process.

The successful leather manufacturer to-day must be able not only to detect trouble at its beginning but must also know how to overcome it quickly. He must be a crank and at the same time must guard against being hypercritical. When his process is running

right keep it there and suffer no change to be made without running through several experimental lots, being sure that the improvement warrants the change. Many times a slight alteration to correct some minor trouble brings on further difficulties later and also breaks up the routine, causing hold-ups and variations in the finished leather.

There is one fundamental rule which, if adhered to, means success provided the process is correct to that point, and that is: Stock should not be held up in process from the time it enters the soaks until it is dried out, either in the crust or on the tacking frames. It may then be put in a cool room and kept there—the longer the better—the reason being to bring the stock into an imputrescible and insoluble form as soon as possible, and to obtain uniform results this must be done in routine form.

BEAM HOUSE

The object in the beam house is not only to take off the hair and epidermis but also to extract some of the cementing substance or glue which binds the fibers, and finally to bring the stock into proper condition for tanning. This is accomplished by first soaking the raw stock in clean water, which not only washes off the blood, dirt and salt but also brings the stock into a flaccid condition so that the lime will penetrate and swell the gelatin, thereby opening up the bundles of fibers and extracting some of the gelatinous substance with which they are cemented.

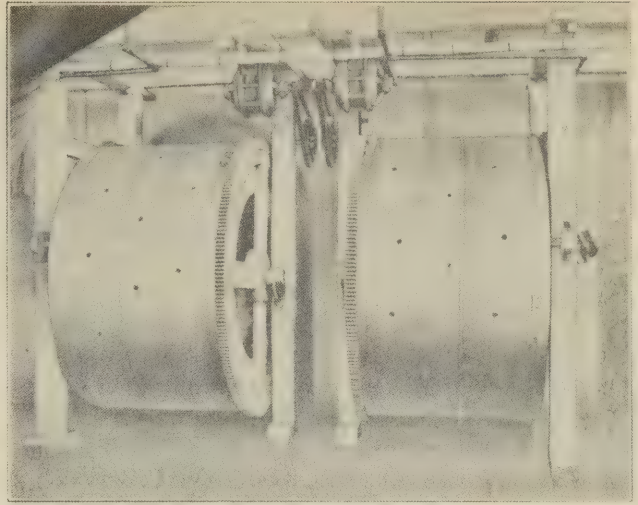
SOAKING

The pelts from cows, steers and horses are called hides, and those from calf, sheep and goat are called skins. Hides and skins come to the tanner in several different conditions, and consequently must be handled differently to get them into condition for liming.

Hides and skins, from tropical and semi-tropical countries, which have been subjected to a rapid drying process are called "flint" or "dry" hides or skins. This not only reduces freight charges but also preserves the stock if it has to be held a long time in warm places.



Fleshing and Unhairing Machine



*Wash Drums
Chas. H. Stiehling Co., Milwaukee, Wis.*

Native hides and skins are first salted down in beds to extract the moisture, and then shaken out, resalted and bundled, and are received in this condition by the tanner and are called "green salted."

Intermediate of these two classes we have hides and skins which are first salted, then dried by a rapid process, and are called "dry salted."

DRY HIDES

Dry hides and skins require a much longer soaking to bring them back to their original suppleness, which is necessary to insure proper liming. They are first immersed for forty-eight hours in a very weak solution of bichloride of mercury to kill the anthrax spores, then put into a fresh soak to which salt or sulphurous acid is sometimes added to assist in softening. After the stock has become fairly soft it is pulled out, milled, trimmed and fleshed. It is then put back into a fresh soak and left there until it reaches the proper suppleness, this depending entirely on the nature of the pelt. Hides and skins dried out at excessive temperatures always require excessive soaking.

GREEN SALTED

The soaking of green salted hides and skins is altogether different. They are shaken out from the bundles, trimmed, milled for fifteen minutes in running cold water to wash off blood, salt and manure, and are then placed in the soak vats with clean water at 65 deg. Fahr. and next day fleshed by machine to remove the connective tissue, which is very impervious to the subsequent liquors. The stock is then put back into clean soaks for twenty-four hours, at the end of which time it should be in proper condition to receive the lime. It is very important that the soaks be kept clean to prevent the excessive growth of bacteria, which will produce putrefaction; also that the temperature be kept constant at 65 deg. Fahr.

(To be concluded.)

Laboratory Methods of Dyeing and Testing Cotton Dyestuffs

A Working Description of the Apparatus, Materials and Methods Used in Testing the Various Classes of Dyes Applicable to Cotton

By P. F. ESTEY

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HAVING read with much interest the article of Walter M. Scott, Ph.D., on "Standard Methods for Testing Dyestuffs," in the October number of THE REPORTER, I am prompted to offer the results of my experience in this field. My intention is, however, to dwell especially upon dyestuffs for the cotton trades so that the recital of my methods will not overlap those so helpfully described by Dr. Scott, who had the silk trade more particularly in mind.

I will devote some space to describing my methods of cotton dyeing in the laboratory; for I consider it very essential to have consistent dyeing methods, so that a skein dyed last year may be accurately compared with one dyed to-day. These comparative dyeings not only save the chemist much unnecessary testing but are invaluable to the works dyer in computing his formulas for compound shades.

APPARATUS

One of the first elements necessary to the successful testing of dyes is care in the selection of proper apparatus. Two balances are necessary—one for weighing the actual dyestuffs, and the other for the chemicals used. The dyestuff balances should be of 50 grams capacity and accurate to 0.0005 gram. A watch glass is used on the left pan as a dyestuff container, and the tare and weights are always placed on the right pan. A fine camel's-hair brush is used to sweep the traces of dye remaining on the watch glass into the dye beakers, except when the dyes are quite damp, in which case the wash bottle comes into play. Care must be taken to keep all dyes away from the working parts of the balances, and any traces of dyes should be removed at once with a damp cloth.

The coarser balances are employed to weigh the chemicals used in the dyeing processes. They should have a capacity of 250 grams and be accurate to about 0.01 gram. A piece of heavy brown paper is used on each pan, the left as a container for the chemical to be weighed and the right for the weights. The papers are easily balanced before weighing. These balances, too, must be kept scrupulously clean and covered when not in use.

The dye bath is a rectangular tank made of hammered copper. It contains a closed steam coil which heats the water to the boiling point. The top plate has six, eight or twelve holes of a size sufficient to allow the dye beakers to pass it but at the same time small enough to prevent

them from slipping through. The bath should be filled with water to within approximately 3 inches of the top. When the water is at the boil it will heat the dye liquor within the cups to about 195 to 205 deg. Fahr. and maintain this heat throughout the process.

The dye beakers are of porcelain, of 550 c.c. capacity, and are glazed throughout. A brand should be chosen that is consistent in size, so that any beaker will exactly fit any hole in the dye bath.

The yarn or cloth to be dyed should be weighed exactly and one weight of yarn or cloth used for all tests. The writer has found from experience that a 20-gram skein of yarn is sufficient for all tests, besides approaching nearest to the ratio of the weight of yarn or cloth used in the dyehouse to the weight of dye liquor; therefore, 400 c.c. of dye liquor is necessary for each test. Before dyeing the cotton material should be well kiered in the works and otherwise treated, as are the bulk goods. It is well to use bleached cotton in dyeing sky blues, pinks and other bright tints; for the darker shades unbleached yarns will suffice. The skeins are hung in the dye cups on glass rods which rest on the tops of the cups and are turned every few minutes during the process.

SOLUTIONS

A great saving of time is accomplished by keeping on hand solutions of all the staple chemicals used in the dyeing processes. Glauber salt solution is used for the direct dyes; sodium sulphide, common salt and soda solutions are necessary for sulphur colors, sodium nitrite and muriatic acid solutions for developed dyes, and caustic soda and acetic acid solutions for reduction vat colors. I use the following proportions:

Solution	Grams of Salt in 1 Liter
Glauber salt	40
Common salt	40
Sodium sulphide	25
Muriatic acid	100
Sodium nitrite	60
Acetic acid	100
Caustic soda	100
Sodium carbonate	60

The proportions allow a convenient measurement for the amounts to be used.

LABORATORY DYEING PROCESSES

Having set up the necessary apparatus and made up the stock solutions, we will start the actual dyeing.

Direct Cotton Dyestuffs.—A 2 per cent dyeing, based on the weight of the yarn, is quite satisfactory for the fancy shades in direct cotton color dyeing. This would necessitate 0.4 gram of dye for the 20-gram skein. Ten per cent of Glauber salt is used to force the color into the cotton, which is 50 c.c. of our stock solution. The dye beakers are made up first with the Glauber solution and 350 c.c. of water, placed in a row conveniently by the balances and covered with watch glasses. Suppose six dyeings are to be made. A list is prepared showing the percentages used, the names of the dyestuffs, the manufacturers and the order of the cups in the bath. The following list will illustrate the method:

- 2 per cent Direct Blue 2B Conc.
- 10 per cent Glauber's (Calco.)
- 2 per cent Erie Fast Red FD
- 10 per cent Glauber's (National)
- 2 per cent Chrysophenine Ext. Conc.
- 10 per cent Glauber's (Du Pont)
- 2 per cent Direct Green B
- 10 per cent Glauber's (Newport)
- 2 per cent Brown C
- 10 per cent Glauber's (National)
- 2 per cent Direct Fast Yellow NN
- 10 per cent Glauber's (Newport)

A sheet of heavy paper is placed in front of the balances to catch the excess dye and any that may spill from the bottles or envelopes. Now the 0.4 gram of Direct Blue 2B Conc. is weighed exactly and placed in the dye beaker at the extreme left of the row. The beaker is covered with the watch glass and the weighing is continued until the list is completed. The cups are placed in the dye bath in the same order as they appear on the list, everything being done from left to right.

While the dyes are being weighed the 20-gram skeins are being boiled out in a pan of water with the addition of a little soap or good soluble oil. They are then washed thoroughly and wrung evenly between stout glass rods. Glass rods are placed in the dye beakers and the solutions stirred until the dyes are dissolved and the liquors have reached the temperature of the bath. Any difficulty in dissolving the dyes, or insoluble matter if present, is noted at this point. The skeins are now placed on the rods, lowered into the dye cups, turned, and the time of starting noted. The dyeing is continued at the given temperature for one hour, care being taken to turn the skeins every few minutes to insure evenness. Tags are made out giving percentages, names of dyes, manufacturers, and date. At the end of the hour the skeins are removed in the given order, washed in a pan of clean, cold water, wrung evenly with glass rods, ticketed, and hung up in the drier.

In dyeing direct blacks 10 per cent of dye and 20 per cent of Glauber salt are used; for sky blues and pinks $\frac{1}{2}$ or 1 per cent of dye and 10 per cent of Glauber salt. Light tints often dye better at a lower temperature.

Developed Dyes.—For fancy shades 4 per cent of dye is used with 20 per cent of Glauber salt. Run one hour under the boil, as for direct colors, and then wash and wring. Prepare a bath of 5 per cent sulphuric acid and 3 per cent sodium nitrite, and lower the skein into this solution, run twenty minutes cold, and wash.

Dissolve 1 per cent of beta-naphthol in $\frac{3}{4}$ per cent of caustic soda and 20 c.c. of water at the boil. Place in the dye beaker and make up to 400 c.c. Run the diazotized skein in this bath cold for twenty minutes, and then wash.

For developed blacks use 10 per cent of dye with 20 per cent of Glauber salt and run as above, except that some other developer may be necessary to give the jet black required. The dye manufacturers specify the necessary developer.

Formaldehyde After-treatment.—Some direct dyes are made faster to washing by an after-treatment with formaldehyde. This is carried out by using $2\frac{1}{2}$ per cent of formaldehyde, running thirty minutes at 120 deg. Fahr. Wash thoroughly.

Chrome and Copper After-treatment.—Many direct colors, such as Direct Sky Blue FF and others, are made faster to light and washing by an after-treatment with chrome and blue vitriol. After washing, immerse the yarn for fifteen minutes in a bath of 3 per cent sodium bichromate, 3 per cent copper sulphate and 3 per cent acetic acid at 160 deg. Fahr. Wash well. The dyes change in shade considerably, and so patterns should be kept of the yarn before and after coppering.

Sulphur Dyes.—The following percentages will answer for most of the sulphur colors: Six per cent dyestuff, $4\frac{1}{2}$ per cent sodium sulphide conc., 20 per cent common salt and 3 per cent calcined soda.

The sulphide solution (36 c.c.) is placed in 100 c.c. glass beakers, the dyestuffs added, and the beakers covered with watch glasses. After all the dyes have been weighed they are stirred carefully until the dye is all in suspension, and then the beakers are heated over the gas burner on a copper plate. They are stirred several times to prevent the dye burning on the bottom of the beaker. The solutions are boiled a few minutes, and then the beakers are removed from the plate. The liquors are poured into dye beakers and the glass beakers washed out with a measured quantity of water necessary for the dye cup, each one being examined for insoluble matter or undissolved dye. It is necessary to use a higher percentage of sodium sulphide with many of the concentrated dyes than is here suggested, experience teaching the chemist the proper amount. Too much sulphide must be avoided, as it holds the color back from the yarn and tends to give unreliable results. At the same time enough sulphide must be used to dissolve all the dye and keep it in solution during the dyeing process. The 20 per cent of common salt (100 c.c. of the stock solution) and the 3 per cent of carbonate (10 c.c.) are now added, and the dye

cups placed in the dye bath to get hot. The skein should be kept below the surface during dyeing, so as not to oxidize the sodium sulphide more than is necessary. For this purpose the skeins are lowered on specially bent glass rods either in the form of a capital U extended at both sides so that the center hangs well within the cup while the sides protrude over the edge, or in the shape of a shepherd's crook. There are many sulphur dyes that are completely or partially reduced by the sodium sulphide. Blues and green are more susceptible to reduction than browns or yellows. The dyed skeins are washed and dried after an hour's dyeing under the boil. If some of them are of the reducing type the yarn should be oxidized in the air before washing. Any characteristics noted out of the ordinary, such as reduction, insoluble matter, heavy scum on the surface of the dye liquor, etc., should be recorded with the tests of the dyes.

In dyeing sulphur blacks the following proportions will answer for nearly all of the dyes: Fifteen per cent dyestuff, 12 to 15 per cent sodium sulphide conc., 30 per cent common salt and 5 per cent carbonate of soda. Dissolve the color in thirty times its weight of water with the sulphide necessary. The most concentrated black will need an equal weight of sodium sulphide.

Most of the sulphur colors are improved in fastness to light and washing by an after-treatment with bichromate of soda and copper sulphate. The following percentages are used: Four per cent blue vitriol, 3 per cent sodium bichromate and 3 per cent acetic acid.

Run the skeins in this bath for fifteen to twenty minutes at 160 deg. Fahr. Wash and dry. Where it is the practice to after-treat sulphur colors it is well for the chemist to chrome and copper a portion of each dyed skein and record the after-treated part beside the original dyeing so that the dyer may note the change in shade caused by the after-treatment.

Basic Dyestuffs.—Cotton yarn must be mordanted before dyeing with basic colors. The well-boiled-out yarn is first immersed for one hour in a 2 per cent bath of tannic acid at a temperature of 120 deg. Fahr. The skeins are wrung carefully without washing, and then run fifteen minutes cold in 1 per cent of antimony salts. Wash. This treatment fixes insoluble tannate of antimony on the yarn, which acts as a mordant to the basic dyes. One per cent of basic color is used for the test. It is dissolved in 100 c.c. of water, boiled, and transferred to the dye beaker; 300 c.c. of cold water is added. Place the skein in the cup, dye ten minutes cold and ten minutes at 120 deg. Fahr., and heat for ten minutes to 160 deg. Fahr. Wring without washing, and dry.

Some of the American basic dyes, especially the green crystals and violets, contain a certain amount of insoluble tarry matter, which rises to the surface of the dye liquor and causes spots and stains on the dyed material. This characteristic is enough to condemn any dye. The solubility of the dyes should be noted carefully, as some of them are rather difficult to dissolve.

Reduction Vat Dyes.—We now come to that class of dyestuffs so difficult to manufacture and yet so perfect

in fastness to most of the color-destroying agencies—the reduction vat colors. These dyes come on the market in the form of pastes or powders. They must be reduced to the soluble compound by hydrosulphite of soda, and held in solution by the hydro and caustic soda. The fancy shades are dyed with the following proportions: 10 per cent dye paste or 2 to 4 per cent dye powder, 5 per cent hydrosulphite conc. and 5 per cent caustic soda.

The weighed dye is washed into a 200-c.c. bottle, 100 c.c. of water added, and then the hydro and caustic. The liquor is shaken up and the bottle placed in a pan of water at 140 deg. Fahr. After a few minutes the dye takes on the reduced appearance and looks like a light-colored solution, except for the very thin film of oxidized color on the surface. Some dyes must be heated to 180 deg. Fahr. to reduce them. After reduction is complete, the liquor is placed in the dye beaker, the bottle washed out with the rest of the water, and contents added to the other liquor. The dyeings are run for forty-five minutes at 120 deg. Fahr. The sulphur rods are used to hold the skeins under the surface of the liquor. The skeins are removed from the cups, wrung evenly and allowed to oxidize in the air. When oxidation is complete, wash the skeins thoroughly and immerse in a 5 per cent bath of cold acetic acid for ten minutes. Wash again, and give a ten minutes' soaping with 3 per cent of good tallow soap at the boil. A final wash completes the process.

The powdered dyes will need more time for reduction than will the pastes, and care must be taken that all the particles have passed into solution. For heavy shades 25 per cent of common salt may be added to the dye bath after running a few minutes, inasmuch as the salt tends to force the dye into the yarn. If the dye is properly reduced the vat dyes cause very little trouble in handling and give consistent results.

Recipes for other types of vat dyes are as follows:

Algols.—Ten per cent dye paste, 6 per cent hydro and 3 per cent caustic. Dissolve at 120 deg. Fahr. Make up the bath, add 50 per cent of common salt, and run cold for forty-five minutes. Complete the process as under the fancy vats.

Indanthrene Black B.—Sixty per cent dye paste, 18 per cent hydro and 12 per cent caustic. Dissolve at 160 deg. Fahr. Make up the bath, add 20 per cent of Glauber salt, and run forty-five minutes at 176 deg. Fahr. Oxidize in the air and wash. Develop the black with a 2 deg. Tw. chemical solution, running cold for thirty minutes. Wash, sour, wash and soap.

MONEY VALUES

Our laboratory method for money value tests is quite similar to Dr. Scott's. If two Direct Blue 2B dyes cost 85 and 90 cents, respectively, a 2 per cent dyeing is made of the first and 85/90 of 2 per cent of the 90-cent dye. The heavier shade is the cheaper dye to use. If the difference is considerable, it is often advisable to make two more dyeings of equal depth to assure the purity of shade.

MIXTURE TESTS

Many dyestuffs on the market are a mixture of two or more straight colors. If the chemist does not make mixture tests and throw out the complicated conglomerations the dyer may be using five to seven or eight dyes in his bath instead of two or three. If the lowest number of dyestuffs possible is used there will be a minimum chance for unevenness due to the dyes.

The mixture tests are made as follows: With an indelible pencil write on the rough side of a clean piece of white blotting paper (about 4 x 6 inches) the name of the dye, vender and date. Place the paper on a large square of glass and wet it out evenly. Allow the excessive water to drain off. Dip the clean blade of a jackknife into the dye sample, taking about one-tenth of a gram or so, and blow the dye evenly over the blotting paper. The particles spread out and any mixture is soon detected. The tests may be dried and kept for reference.

In making mixture tests of sulphur colors, wet out the blotter with a solution of sodium sulphide instead of water, and proceed as above.

EXHAUST TESTS

There are two types of exhaust tests: the first a standing bath type, such as direct black; the second a process by which the exhaustive powers of a mixture of colors used to produce a given shade are noted. This second test will in all probability show us whether the colors will work well in combination or not.

The standing bath-type test is conducted as follows: For example, in the comparison of two direct blacks make a money value of the two, using 10 per cent of the new dye with 20 per cent of Glauber salt. Dye an hour and wring carefully over the dye cups, allowing the extracted liquor to fall into the beakers. Add 10 per cent more of Glauber salt to each cup, make up to 400 c.c. and dye a third skein in each liquor. In some cases it will be found that the lighter first dyeing has the better exhaustive properties. In this case the chemist must add the probable amount of dye to the exhaust test to make them of even depth, and figure this added dye into his calculations.

In conducting tests of the second type let us assume that the shade necessary demands the following dyes and percentages: One per cent Direct Blue 2B, $\frac{1}{4}$ per cent Direct Black Conc. and $1\frac{1}{2}$ per cent Direct Brown M.

Make the first dyeing under the usual conditions, wring the skein thoroughly and allow the liquor to fall into the cup. Then add 75 per cent of the dyes in the same proportions as above, half the first amount of Glauber salt, and make up to 400 c.c. Dye a skein in the reinforced bath, wring as before, and add 70 per cent of the dyes used with half the first amount of Glauber salt. Make up to 400 c.c. and dye the third skein. A comparison of the three skeins will show the exhaustive characteristics of the dyes used. A slight variation in shade may be overlooked, but if one of the dyes predominates consid-

erably in the two exhaust dyeings it points to a difference in the working powers of the dyes and it may be well to try another combination.

We have often noticed a dye in combination rush on to the cloth in the first part of the jig dyeing, and the latter part of the batch has been almost void of that dye. The exhaust tests show up this discrepancy.

COTTON DYESTUFF TESTING

After having dyed our samples according to standard conditions, we are ready to consider the actual fastness of the dyes to color-destroying agencies.

Fastness to Light.—A 4-inch portion of the dyed skein is fastened with staples on a sheet of heavy cardboard. The board should be about 6 inches wide and 10 inches long. The upper 2 inches is bent down over the top half of the yarn to be exposed and fastened with staples, thus allowing half of the dyed sample to be exposed and the upper half protected from the light. The prepared sheets are then placed under glass in a frame and exposed to light for the proper length of time. It is always well to include samples dyed with similar dyestuffs used in the works to serve as comparison, as the strength of the sun varies from day to day and some dyes need longer exposures than others. We have tried out several exposure calculations based on the months of the year, and find them too unreliable for use.

Fastness to Washing.—The fastness to washing test may be applied in two ways: a severe test and a mild one. In either case the dyed yarn is braided with bleached cotton yarn and a 3-inch portion of the braid used for the test. The mild test is as follows: Make up a soap solution, 1 gram of good tallow soap to 1 liter of water, and use 25 c.c. for the test. Heat to boiling and place in a small evaporating dish. Put the braid in the dish and squeeze it thoroughly. Allow it to remain ten minutes in the cooling soap solution, squeezing every minute or so. Wring and dry. The best direct colors when dyed in medium shades will stand this test fairly well if the yarn is properly washed after dyeing.

Yarn dyed with sulphur and vat dyes should stand the severe test with no bleeding and very little change in shade. Fifty cubic centimeters of the above soap solution is heated to the boil, the braid added, and boiled for ten minutes. The poorer sulphur dyes and any that are not well after-treated or washed will run considerably in this test.

Fastness to Warehouse Storing.—Dyed goods are often stored for several months in warehouses before they are taken out for use. Many times damp cellars in city blocks are used for storage purposes, and the action of the sulphurous fumes of the dyes is often very severe. Vat colors and after-treated sulphur dyes stand this action without change, but many direct dyes are completely altered in character of shade by these cellar gases. We have taken several altered shades and made up a test which reproduces the action of the gases in a few minutes. Fifteen grams of powdered bisulphite of

soda is dissolved in 100 c.c. of water in a dye cup. Place the beaker under a bell jar. Make a T for holding the pieces of cloth or yarn to be tested and place the T and samples near the dye beaker. Take the bell jar in one hand and with the other add to the beaker 20 c.c. of concentrated muriatic acid. Place the jar on the glass plate at once, so that the sulphur-dioxide gas does not escape. Leave in the samples for thirty minutes, then remove. They should be compared with the originals at once, and again after standing twenty-four hours. Sometimes the change in shade disappears with the escape of the gas from the exposed sample. Dyes not fast to acids will make a poor showing in this test, and should not be used if the goods are to be stored for any length of time.

Fastness to Scrubbing.—Some sulphur dyes will be fast to boiling soap and yet give a poor scrubbing test. If a band of navy is to be sewed on a white middy-blouse it must be quite fast to washing by the home method.

Sew several dyed threads into a piece of bleached cotton cloth and scrub on a washing board with warm soapsuds and a trace of ammonia for a few minutes. Rinse and dry the cloth. Of course, if the dye is satisfactory the color will not run.

Fastness to Ironing and Calendering.—When dyed cloth or yarn is moistened and pressed with a hot iron the heat often causes a decided change in shade. Sometimes the dye returns to its original shade on cooling; some dyes are affected permanently.

If the dyed goods are to be calendered or dressed, the dyestuff should be quite fast to this test.

Fastness to Acids.—Spot the cloth or yarn with a few drops of 10 per cent acetic acid solution, and dry into the material. The change of shade should be very slight.

Fastness to Alkalis.—Spot with a 5 per cent sodium carbonate solution and dry. Brush off the white powder

and compare with the original. If a milder test is required, spot with a 5 per cent solution of ammonia.

Fastness to Chemic.—Make up a 1 to 2 deg. Tw. solution of bleaching powder and treat the dyed sample cold for twenty minutes. Wash and sour in a 1 per cent solution of sodium bisulphite. Wash and dry. The vat dyestuffs should withstand this test perfectly.

Fastness to Rubbing.—Place a piece of white cotton cloth over the rubber end of a lead pencil and the dyed materials outside the bleached cloth. Breathe several times upon the sample and then rub them vigorously together. The color on the white cloth indicates the degree of rubbing.

MOUNTING AND RECORDING TESTS

Dr. Scott's methods of mounting tests and recording results are very satisfactory. Cards should be printed for filing, showing such tests as are necessary for the examination of the dyestuffs. These tests will, of course, vary more or less with the concern interested, and no time should be expended on unnecessary tests. The chemist must find out the requirements of the finished fabrics, and should allow no dyes to be used that do not answer satisfactorily all the necessary tests. There has been a great lack of co-operation between the buyer and the mill along these lines, and no effort must be spared to bring about a common understanding between the interested parties. The buyer should be taught the advantages of the faster dyes, so that he in turn may please his customers with the high quality of his products. And, after all, it is a mill chemist who must decide which are the best and most economical of the dyestuffs on the market. No one dyestuff manufacturer should be favored over his rivals; all make both good and poor dyestuffs, and it is the chemist's task to discriminate.

Laboratory Experiments in Rendering Dyes on Textiles Fast to Sunlight

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A SYSTEMATIC study of the light fastness of dyes requires accurate knowledge of the changes which take place during the bleaching out of dyes on the fiber. The photo-chemic action of light on dyes results in auto-oxidation, and the oxygen attaches itself to the dye in the peroxide form. In the presence of moisture the positive Hydroxyl and negative Perhydroxyl ions play an important part in the formation of the labile dye-peroxide-hydrates. It must, however, be remembered that the light fastness of a dye is not an unchangeable property of that particular dye but is dependent rather in a high degree on the "dye carrier." (See *Chemiker Zeitung*, 1913, page 601.)

The first experiment which suggests itself in determining the action of light on a dye is to eliminate entirely the action of oxygen. This can be accomplished in a purely mechanical way by enclosing the dyed fiber in a glass chamber and then removing the air, but this is of interest only for conservation of very valuable tapestries in museums. Again, it has been said that the light fastness of colors on fabrics can be increased by applying moisture-proof finishes, as experience has shown that colors are very much more fast to light in dry atmospheres than in moist air. This is probably more especially true in the case of cotton colorings. In this connection it is interesting to note that the light fastness

of dyed gelatine films can be increased by an after-treatment with formaldehyde or alum.

Experiments were carried out with such water-proofing agents as rubber, gutta-percha, paraffin, aluminum soap and copper soap, but no great improvement could be observed in any of these cases. It should be noted, however, that C. Frank in 1886 suggested that light fast dyes could be produced by immersing the fiber in linseed oil diluted with petroleum naphtha. The treatment with the above-mentioned water-proofing agents should be of interest in the manufacture of decorative fabrics.

A chemical method for eliminating the action of oxygen on colored fabrics consists in the application of a substance which reacts more readily with the oxygen of the air than does the dye. This again is open to objection because of the difficulty with which the method could be applied in practice. Most oxidizable bodies require but one form of oxygen. (Compare *Faerber Zeitung*, 1910, page 253.) Then, again, those few substances which require both forms of oxygen yield different products on oxidation, and these products may either accelerate or diminish the "fading." Such an "oxygen-absorbing substance" should *not* be capable of acting at the same time as an "oxygen carrier." It will be remembered that these two properties usually accompany each other. The applicability, or rather the mode of action of such an easily oxidized body is limited, as only such bodies are useful as combine readily with the "peroxide form" of oxygen, converting the same into the inactive molecular form. Such substances are unknown up to the present time, but the Catalase which protects the red pigment of the blood against the bleaching action of hydrogen peroxide reminds us that such substances are actually produced by nature.

A practical method for preventing the action of oxygen on dyes is at present unknown, so that we must revert to a means of influencing the primary change which takes place during the photo-chemic destruction of dyes. The formation of the dangerous per-hydroxyl ions must be prevented as far as possible. It is, in fact, possible to stabilize dye solutions in this manner to a remarkable extent. The shifting of the stability of those ions which come into consideration can be accomplished by the addition of acids; in other words, increasing the concentration of the positive hydrogen ions.

In the case of dyed fabrics we are confronted by a different condition. Colorings are usually more fast in acid atmosphere than in pure or alkaline atmospheres, and Jansch has shown that alkaline finishes are especially undesirable where light fastness is required. Finishes showing an acid reaction have no deleterious action on the light fastness of dyes. The difference in action between alkaline and acid finishes is by no means so pronounced as in the case of dye solutions. In the latter case the fiber no doubt reacts with the acid, so that the latter is rendered inert for the purpose for which it has been added to the bath. In the case of cotton dyeing, acids are naturally excluded because of their tendency to form hydro-cellulose. For this reason the method just referred to is of no practical value in the cotton

industry, but deserves consideration where unmixed silk is involved.

The peroxide form of oxygen is at first only loosely bound to the dye, and it is therefore possible to remove it readily. This is accomplished in practice by repeated soaping. It is, in fact, a matter of common knowledge that the light fastness of many vat dyes can be increased in this manner. We may in the future find a catalyst which will split off the peroxide form of oxygen, converting it into molecular oxygen. (This, it will be recalled, takes place during Catalase in the human body.) If it is impossible to split off the peroxide oxygen we must resort to a method of stabilizing the dye-peroxide. The substance which has been found to be most suited for this purpose is Urea. It will be recalled that this substance is the best preservative for peroxide solutions.

Malachite Green, Dianil Pure Blue PH and other dyes were improved to a considerable extent by this treatment, and it may be that the favorable action of Urea in preventing *lousiness of weighted silks* is due to a "stabilizing" of the peroxides primarily formed.

Thio-Urea yields even better results than the mother substance. In all these cases it seems highly probable that the value of these substances depends on rendering more permanent the dye-peroxides. Although these methods are of no practical value to-day, it is quite possible that a knowledge of these reactions will enable us to cope intelligently with problems which may present themselves in the future.

A method was sought for preventing a subsequent reaction between the dye and oxygen, or for changing the usual course of this reaction. This can be accomplished by applying the dye to the fiber according to a suitable method or by after-treating the dyed fiber so that the possibility of a subsequent reaction is eliminated. The following thesis was then set up:

If a dye-peroxide possesses the character of a dyestuff and the shade of the former is not materially different from the shade of the latter, it must be possible to prevent the reaction between the dye and oxygen by introducing such substances into the system which have the power to unite with such atomic groups in the dye molecule as have a tendency toward the formation of a "peroxide." The correctness of this point of view has been proven by experiments. The method to be used for converting the unsaturated dye-complex into the saturated form depends upon the chemical constitution of the complex *dye-fiber*, or, in other cases, *dye-mordant-fiber*, and the behavior of these complexes when exposed to light. Above all, it is necessary to note which groups in a dye molecule are active in the primary addition of the peroxide oxygen. If the nature of the peroxide formation or the constitution of dye-peroxide formed in the presence of light is known, it is possible to prevent this and therefore increase the light fastness. This can be accomplished in two distinctly different ways:

1. By treating the dye itself so that the groups which react in the presence of light are rendered inactive. This may be accomplished by substitution or by condensation in the dye molecule. Such methods frequently change

the dyeing properties of the dye so that they cannot be resorted to in all cases.

Helindon Yellow 3 GM has been investigated thoroughly along these lines, and this method of rendering dyes light fast has been extensively applied in the case of the sulphur dyes. In the "sulphur melt" a peroxide formation undoubtedly occurs. Erdman has shown that this process is essentially a Thiozonid formation.

2. By after-treatment of colored fibers the fact that the peroxide oxygen is at first only loosely bound and further the way in which it is attached to the coloring (by partial valence) indicate that it is necessary to use for the saturation of the open or "ionized" valence such compounds as are capable of forming additional products by means of partial valence. According to whether the dye is capable of reacting in the dark—or is only rendered capable of reacting after exposure to the light; the addition product will be formed in the dark or only after exposure to light. The following methods for overcoming or satisfying the unsaturated bonds are available:

(a) The choice of a suitable "bridge member," that is, the bond between the Auxochrome and the Chromophor. (See *Jour. Prakt. Chemie.*, 1911, page 651, and *Chemiker Zeitung*, 1913, page 601.) In many cases the bridge member does not satisfy the unsaturated valence of the dye and it must therefore be supplemented in such a way that it will form a saturated complex with the dye.

(b) If it is a question of protecting just one group, it is possible to employ substances which are capable of forming addition compounds with that particular group. Or we may use such substances of which it is known that they condense readily with these groups. Condensations are usually preceded by additions. It was also noted that nuclear hydrogen atoms are frequently susceptible to oxidation in which case it becomes necessary to protect these hydrogen atoms.

(c) If active Auxochromes or Chromophors and active hydrogen atoms are present at the same time we must endeavor to establish a bond between these groups, as ring formations, even in the case of ring formations with partial valence, are more stable than simple addition products. (See *Berichte*, Vol. 41, page 3465.)

Many of these reactions are entirely out of the question for practical application. We are acquainted with many "addition reactions" of inorganic or organic substances and it would seem to be quite easy to find suitable compounds for saturating the active valence in a dye. This is, however, not the case. In the first instance the affinity of the substance which is to render a certain group inactive must be greater than the affinity of oxygen for that group. If this is not the case they will fail to accomplish their purpose. Then again light in many cases exercises a schismatic action on such compounds. We have known for some time that light rays exercise a hydrolizing action but the fact that they exercise this action on dyes was demonstrated by the following experiment:

Malachite Green is soluble in carbon tetrachloride

provided the dye is previously dissolved in a small quantity of alcohol and this solution is then diluted with the Tetrachloride. The alcohol can be removed by evaporation and this way a solution of Malachite Green (having a definite boiling point) is obtained. In this case we have a complex compound, which may be boiled for hours without suffering any change, but a few minutes' exposure to sunlight will suffice for breaking up the addition compound. This is accompanied by a separation of the dye. Moisture in some cases has a tendency to break up addition products so that certain colorings are stable only in dry air. In other cases we have the reverse conditions. In such instances there is probably a hydrate formation similar to the entrance of ammonia in complex compounds. A rational method of after-treatment would, however, be as effective in moist air as it is in dry air, further it is necessary that the substance used for the after-treatment retain its protective power under all conditions of illumination. For example, in some cases the light fastness toward direct sunlight is good, whereas the same coloring exposed to diffused daylight suffers considerably. This is no doubt due to different absorptive power of the Chromophor and Auxochrome, and is noticed especially in the case of dyes of the type of Malachite Green and Methylene Blue. (See *Zeitschrift Angewandte Chemie*, 1911, pages 1807 and 2426; *Journal Praktische Chemie*, 1911, pages 84 and 561; *Faerber Zeitung*, 1910, page 253.)

A method of after-treatment which protects the Diethyl-Amido group in Malachite Green from the action of oxygen is of no value in the presence of light rays of short wave lengths. In this case it is the carbinol carbon atoms which are concerned. This peculiar protective action of an after-treatment is of importance primarily in the case of addition reactions. They usually act on but one group in the dye molecule. It is therefore in any case desirable to effect a ring formation, and thus create a saturated complex. Here, however, we must consider not only the chemical character of the components but also the proportion in which they are used. For example: A substance which is capable of binding the ionized valences of the dye molecule must needs be unsaturated. It is therefore itself exposed to photo-chemic auto-oxidation and it may in turn comport itself as an "acceptor" toward the dye. In this case an excess of the substance used for after-treatment must be avoided. The aim must be to convert the colored fabric into a complex compound possessing no ionized valences whatever. It must also be borne in mind that after-treatments should not change the shade of the dye. This depends upon the manner in which the substance used for after-treating is attached to the dye and it remains for us to choose suitable "bridge members," so that the saturated dye complex possesses the same shade as the original dye. The methods which will be described in Part II of this article do not cause any change in shade of the dye.

(To be concluded.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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THE DAWN OF 1921

ACCOMPANIED by the usual noises, if not quite the usual celebrations, 1921 has arrived to find a world about to enter the second stage of its recovery from the great evil done it by the New Year's dissoluble elder brother, 1914. Little did most of us dream what the latter held in store, nor how many of his brothers would be patterned after him. Yet it is from the effects of his profligacy that we are still engaged in recovering from, despite the fact that we began more than two years ago, and without going into unnecessary detail it may be said briefly that we got off amazingly well and are making remarkable progress.

This is cold cheer indeed to the thousands who are feeling the financial pinch and the buyer's market. Nevertheless there are few among even these who will not concede that in the light of past experiences they were liable to a greater calamity than the one which Fate has finally decided to apportion them. Predictions of a general panic were not wanting, and while a few danced upon the edge of the crater until the thin crust gave way, many more held back somewhat and shaped their plans to worry through whatever might befall. We escaped a panic, and 1921 dawns upon us at the psychological moment when the "falling action" is almost checked. The turn of the tide has been reached with the turn of the year; from now on we may look forward to improved conditions.

The retailers have had their fling and the public, too, the latter of late months having been pretty well cured of the "buying for the sake of buying" habit. Many newspapers have helped to produce the general penuriousness which has had such a distressful effect on all markets by their reckless predictions of further huge reductions to come, while politicians, currying favor, have told the public to break prices by waiting

until after the holidays before resuming normal purchasing, particularly purchasing which affects the textile mills. All this has had its force, but if it has proved effective in one way it should likewise prove effective in another. Having been told to wait until after the holidays, the public will soon be in the proper frame of mind again to meet reason with reason. There is no good cause why prices should be driven down still lower, and every cause for renewed activity in the stores, which will be felt all along the line, even unto the dye manufacturers. Purchases deferred for a month or so will now be made on the theory, which an enlightened press is helping to give currency, that the bottom has been reached. People will argue that they must wear clothing and that the present is as good a time as they will see this year to make up deficiencies in their wardrobes. The politicians have all been elected or defeated and will not bother with the public again for some time. The danger that prolonged abstention from buying would in the end bring on another general soaring of prices—in which case the whole trying business would have to be gone through with again—is clearing.

Great inflation followed the war, and then the inevitable liquidation which, had it not been for our improved banking system, might have resulted in the much-dreaded panic. Now, at last, comes the beginning of the return to normalcy, which may take some time, but is nevertheless the outstanding feature of the dawn of 1921.

THE OBVIOUS THING

WHILE waiting for the United States Senate's reaction to the safe and rapid passage of the British dyestuffs import regulation measure, you may read anew in the daily papers that there is only enough money invested in the infant dye industry in this country to pay the cost of building seven or eight "capital" battleships—not more than ten at the utmost. You also read that the English press generally has been voicing the opinion that England has not money enough to retain her traditional control of the seas if the United States chooses to compete with her in naval construction. Supremacy, it is said by British writers, can be maintained only at a cost to England which would prove ruinous, and if America sets about the task of creating the larger navy, she has the money to do so while England has not.

That is indeed something of a concession from a country to which the control of the seas has been a creed for many generations, and it is, further, perfectly true. We know the financial condition of England as a result of the war, and we know that our suggested naval program contemplates spending many times over the total sum invested in the dye industry here.

You may expect to hear at some not too far distant date a proposal from England for a mutual limiting of navies; the proposal will likely state—although not

in so many words—that the size of our navy shall be limited to what the British think they can afford to spend on fighting craft during the next few years, with Japan a possible third party to the agreement. Already it has been hinted that if Japan should prove reluctant to submit to any such proposal—the United States agreeing—and attempt to dispute the matter, England would unhesitatingly back the United States against her former ally.

All this is not so far removed from the issue of the dye industry now before our Senate as it might appear. To build and equip the mightiest navy costs hundreds of millions. To maintain, keep in repair and keep up-to-date such a navy costs hundreds of millions more every year, and not one cent of the money goes for the production of anything remotely useful unless war occurs. Yet it must be done, just as the premiums on an insurance policy must be paid. The navy is the first line of defense for any country with a seacoast to protect; a navy cannot be built after trouble occurs, and the weaker a country's navy is the greater are the probabilities that trouble will occur some day. England, in financial straits, finds that her limit of naval expansion is far inside the United States' limit. She does not expect or look for war with the United States, but purely as a matter of policy she does not desire to see any country get ahead of her; hence, she will do 100 per cent of what she can in this direction and then trust to diplomacy to prevent anyone else from exceeding her own power. The war demonstrated in rude fashion that what practically amounts to another first line of defense is a complete repertoire of coal-tar chemical industries—and there, again, England has done 100 per cent of what she could to insure herself this protection. She will attain complete self-sufficiency in this respect without having it cost her anything at all, and she will then develop her other defenses—navy, army, etc.—to the very greatest limit which her pocketbook will permit, not hesitating to renounce her previous friendship for Japan in order to make sure that neither the latter nor the United States shall be in a position, except as allies, to easily overwhelm her. In her present position, it is the entirely obvious thing for England or any country to do.

What attracts you is the great simplicity of the whole course of action and the efficiency with which it is being worked out. A study of England's actions does not reveal a menace, as the Hearst newspapers would have it, but an excellent example to follow. Self-preservation is the very first law of nature; England and the United States are and should be natural allies, but England merely refuses to leave any stone unturned in her effort to make herself as invulnerable as possible, come what may. Having been dealt a certain hand by Destiny, she plays that hand so as to derive full value from every card, high or low. She methodically selects the obvious things to do in order to provide herself with as close an approach to 100 per cent protection as possible under the present cir-

cumstances, and then just as methodically selects and works upon the most obvious ways of doing them.

As an instance of this, the enactment of the British dyestuffs legislation will always stand forth as particularly striking. England needed the same rigid protection for her dye industry that any country needs which essays to keep home markets from the German dye makers, and protection of that sort she proceeded to establish with very little fuss over the matter. Then came the absurd Sankey decision, which, although many claimed it was not in accordance with the law, nevertheless rendered that law practically invalid for a year. England, beset by such a multitude of problems as to try the mettle of any legislative body, allowed affairs to drift—but not past the danger point! Seeing their chance, opponents of drastic protection in that country proceeded to create dissension, and this brought about a considerable delay; for the Government, while being committed to the licensing system, would not permit the artificially contrived minor differences to be thrashed out in Parliament, and served notice on both parties to this effect. Meanwhile, the kartel had not been idle and dumped \$22,000,000 worth of dyes into England to sell at prices with which the English, of course, could not compete. Nothing more was needed to clear away the temporary fog from the eyes of British dye consumers as a body; the effect of renewed German domination in years to come was again seen clearly, differences were speedily settled and, the licensing system being recognized as the obvious thing to check further inroads, a licensing system designed to run ten years was installed almost before we in this country fully realized that the measure was up in Commons.

What the Dyestuff Import Regulation Act does and does not do are worth looking at. It does not, for instance, prevent any English color user from obtaining any color he happens to need, no matter whether it must be supplied by Germany, Switzerland or the United States. It does not interfere with his production, does not make it a hardship for him to get what he wants, nor does it prevent importers and exporters from bringing into the country anything which they can find a market for outside of England. On the other hand, it does assure the English dye manufacturer a market for his goods and a chance to develop new goods unmolested, and it assures him a market for any new goods developed within the next ten years. It takes the attitude that it is either all right for a certain dyestuff to be imported into the country, or else all wrong; it is no half-way measure. Above all, it is as good as guarantees that England shall eventually have a dye industry of her own, a dye industry fully capable of supplying all domestic needs and of competing with other nations in the markets of the world. It is the only kind of a measure that could do all these things and satisfy all parties concerned. Therefore, it was the obvious measure to adopt and England proved her wisdom by adopting it so speedily.

Over here, it is just as obviously the thing to do. One would call insane a drowning man who repeatedly refused to take hold of a rope dangling well within his reach. Yet that is just what the Senate has refused to do in behalf of our own dye industry—which is quite as important to us as England's is to her. The Dye bill would apply here identically the same principle that shapes the English act, with what appears to be a decided improvement—the designation of the Tariff Commission to administer the proposed law instead of the committee of color makers, users and neutrals provided for in England. This does away with the objection once raised here that dye users serving on such a board would have an opportunity to scrutinize too closely the affairs of their business rivals, to the detriment of the latter. This should be avoided, and the Tariff Commission cannot be accused of having preferences among color users.

The most recent talk here is to the effect that Senator Penrose holds fast to his intention to prevent, if possible, the consideration of any "popgun" tariff bills during the present session of Congress, and when Senator Penrose refers to popgun tariff bills he mentally includes the Dye bill, which he favors but misunderstands. Senator Knox, a loyal supporter, declares that he may find an opportunity to attach the Dye bill to the emergency tariff legislation which was passed by the House just before the Christmas holidays and which must now take its chances with the Senate after New Year's Day. It is said, however, that President Wilson will veto this measure if passed by the Senate—yet the President is known to favor most heartily the Dye bill. Should this occur, it would be a complicated task to rescue the Dye bill and have it presented alone and on its own merits, as it ought to be.

The accomplishment of such a task would not unlikely require too much time to enable the present Congress to act favorably upon it, and altogether it would be a pity thus to jeopardize its chances of prompt action by injudicious haste. Better by far, it would seem, to endure yet a few more weeks of delay than to bring about a certain additional six months or so of waiting—with the imminent possibility of peace being declared with Germany in the meantime.

Let us build our navy up, by all means, spending whatever sum is necessary to make us safe from threat of attack, but let us not commit the folly of neglecting quite as important a means of defense which will be ever ready and cost the country nothing to maintain.

The dye barons tell the world of their troubles and complain bitterly (?) of the manner in which the United States is ousting them from world markets. However, those who have had experience with them can readily make it plain to the unwary that these gentlemen would never dream of showing their real hand while the Dye bill is still pending. That would be the surest way to send it through with great speed—which the dye barons do *not* want to have happen.

England knew this and knew that the veiled opposition of Germany was a certain indication that the licensing system was best for England. The passage of the Dye bill here is so obviously the thing to do that the weeks of enforced indifference on the part of the Senate leave certain members thereof open to charges of the grossest stupidity, blindness, or worse.

Why Bleached Cotton Goods Turn Pink

By WILLIAM B. NANSON

WITHIN the past year or two the writer has been consulted many times regarding the "pinking" of various kinds of bleached cotton goods; these include bleached knitted underwear, sheetings and shirtings, drills, white duck and even paper, and bleached canvas shoes. I have been asked to point out the probable cause and a practical way of avoiding its recurrence as well as the best method of restoring the "pinked" fabrics to their original clear white color.

In this article, which gives the result of my investigations and theories in regard to the matter, I shall confine myself more especially to the "pinking" of white canvas shoes, but the facts and theories which will be advanced are just as applicable to any

other style of bleached cotton goods.

In all cases it was found that the goods had turned a bluish shade of pink, which showed decidedly darker in the hollows and seams (where the body of the cloth was thicker and presumably contained more moisture) than in the thinner, smoother and more exposed part of the shoe, and it was also found that while moisture assisted it was not indispensable to the development of a pink coloration.

When making canvas shoes it is customary to paste together the bleached shoe canvas and the unbleached drilling used as a backing or lining. This is done on a pasting machine before cutting up. The two cloths so pasted pass directly to revolving drying cylinders heated by steam which usually dry the double cloth

more or less imperfectly under the more or less careless supervision of an operative who fails to realize the importance of getting these cloths thoroughly dry, for in any case the starchy materials used in making the paste and the chlorides which are usually combined with it as antiseptics are in possession of powerful hygroscopic qualities which are of themselves sufficient to extract the necessary moisture from the air to set up certain chemical reactions which might assist materially in developing a pink coloration.

In proof of this I have found that in certain parts of the goods, where creases or wrinkles in one of the layers of the cloth have occurred in such a manner that the two layers had failed to become pasted together, the bleached canvas did not turn pink at that particular point, though on all sides of the unpasted spot right up to where the paste failed to adhere the cloth was pink enough. Owing to this phenomenon it has been thought by some that the paste itself or the gray drill lining was the cause of the "pinking" of the goods. I do not think so; though they may have acted as secondary agents to hasten and assist the chemical reactions which did cause it, they had nothing to do with its primal cause, for I have found that the bleached canvas, if kept in a dark, moist place away from any air ventilation, would turn pink also if given time, and this without being pasted at all; but it took time and contributory and adventitious circumstances.

My opinion, based upon experiments, observation and actual experience, is that the pinkish color developed upon shoe canvas is caused primarily by the bluing material used in the finishing of the goods at the bleachery, and the safest and sanest way to avoid it is to cut the bluing out and finish the goods a dead white. Bluing canvas for shoes serves no good purpose and adds nothing whatever to the attractive appearance of the finished shoe, because the subsequent pasting and steaming which the goods receive preparatory to cutting up in the shoe factory oxidizes the blue largely into a ferrichydrate and a ferrocyanide which changes its color into a dirty brownish yellow.

In the shoe-making industry the most probable thing that will make for the development of a pink color on bleached canvas is the fumes of aniline and toluidine arising from the "tapsticker" used in putting on the soles of the shoes and, where rubber soles are used, from the soles themselves, but this has been found to happen only where the canvas has been blued with Prussian blue. Aniline fumes have been known to form brown stains upon unblued bleached goods, but never, so far as my knowledge goes, was a pink coloration developed except under conditions which were fully understood and which have no bearing upon the subject matter of this article.

Then, the question at issue is, if aniline fumes are the cause of the "pinking" of white canvas shoes—(1) What is the cause of it? (2) How can it be avoided? (3) How can it be removed after pinking?

When nitrobenzol (which always contains nitro-toluene) is reduced by iron in a fine state of division and in the presence of a dilute acid it becomes converted into aniline and toluidine. All the nitro compounds of benzene (benzol) on reduction with appropriate reagents, such as iron, zinc or tin, in the presence of an acid yield amino compounds corresponding with the nitro compound reduced, such as aniline $C_6H_5NH_2$, the three diaminobenzenes or phenylenediamines $C_6H_4(NH_2)_2$, etc.

These amino compounds, by the action of nitrous acid or nitrites in the presence of an acid in excess, are converted into diazo compounds. These diazo compounds react with certain amino compounds or phenols, giving rise to the almost innumerable series of coloring matters known as azo dyes.

Toluene and xylene, which are nearly always present in all anilines and benzenes, generally react, under similar conditions, in the same way as benzene, producing a similar series of compounds, all of which goes to show that, starting with nitrobenzene (oil of myrbane), there may be found a series of conditions which tend to form a pink coloration on bleached cotton, provided it has been previously blued with a Prussian blue.

Nitrobenzol first made its appearance in the arts under the name of "essence de myrbane," or "oil of myrbane." It was used to scent soap and as a "bitter almond" flavoring. Its manufacture is interesting and is conducted about as follows: 500 gallons of pure benzene (made from coal tar) is run into a mixing tank and constantly agitated, and an acid mixture composed of 5,000 pounds of nitric acid of specific gravity 1.43 and 6,600 pounds of sulphuric acid of 96 per cent, thoroughly mixed, is run in a thin stream into the benzene while the agitators are kept revolving at a speed of 60 r.p.m. The temperature must be kept below 60 deg. Fahr. by checking the flow of the acid if the temperature rises. After a full charge of the mixed acids has been run into the machine the agitation is continued for about four and one-half hours, and the benzene will then be completely transformed into nitrobenzol. There are other details of washing and removing the excess acids, etc., which it is not necessary to discuss here.

TOLUENE

Now, when this nitrobenzol (or nitrobenzene) is to be sold as "oil of myrbane"—and I wish readers to especially note this—it is redistilled under a diminished pressure in order to obtain a perfectly clear and transparent liquid such as the trade demands, and it is customary to use toluene imperfectly freed from benzene for this purpose, it being cheaper and yielding a somewhat more fragrant "myrbane" than ben-

zene alone; the resulting product is, of course, a mixture of nitrobenzene and nitrotoluene.

Toluene when oxidized by nitric acid, as previously stated, and under favorable conditions, may be converted into benzoic acid, and when a ferric salt such as is found upon goods blued with the Prussian blue of commerce is brought into chemical combination with benzoic acid, or a benzoate, a flesh-colored precipitate of basic ferric benzoate, $(C_7H_5O_2)_3Fe$, is formed. This precipitate is $Fe(OH)_3$, and it is to this fact that much of the pinking found upon bleached canvas shoes is due—but not all of it.

TOLUIDINES

Toluidines are prepared by the reduction of nitrotoluenes in the same way that aniline is obtained from nitrobenzol. The para, ortho and meta toluidines may be separated from each other by a variety of processes. The crude product consists of about 35 per cent para, 63 per cent ortho and 2 per cent meta toluidine. The separation of aniline and toluidine—for both are found together in commercial products—is based partly on the different strengths of the bases and partly on the difference in the solubility of their acetyl compounds.

Paratoluidine may be detected in the presence of aniline and orthotoluidine by adding a few drops of ferric chloride to a hydrochloric acid solution of the mixture. If the para compound is in excess a red solution is formed. If orthotoluidine and aniline are present in excess a greenish blue precipitate is formed which, on filtration, yields a red filtrate.

Orthotoluidine is a colorless, thick refractive liquid with a characteristic odor. When dissolved in sulphuric acid it gives a blue coloration with chromic acid, and this, on the addition of water, turns red violet. In alkaline solution it is oxidized with the production of an azo toluene, oxalic acid and ammonia, while in acid solutions it gives rise to quinone derivatives. Printed on cotton fiber it can be oxidized into a red violet or flesh color by means of sodium chlorate and potassium ferrocyanide.

Metatoluidine is a colorless oil which is employed only to a very limited extent in dyeing. It behaves like the ortho compound on oxidation and it yields similar additional compounds with acids and metallic oxides such as ferric salts, etc., and it may be, therefore, so far as this article is concerned, considered the same as the ortho compound. Methyl-orthotoluidine and its nitroso derivatives have been employed largely in the manufacture of the safranines and other pink and red colors.

ANILINE FOR RED

Ordinary fuchsine or magenta, or roseine as it is sometimes called, is prepared by oxidizing a mixture of aniline with paratoluidine and orthotoluidine. This mixture is generally known as aniline for red, and was

originally produced by the nitration and subsequent reduction of a certain fraction of crude benzene which consisted of benzene and toluene. At present most of the aniline for red is a mixture of pure aniline with crude toluene. By the latter I mean the mixture of ortho and para toluidine which is obtained by the nitration and subsequent reduction of pure toluene. Crude toluidine consists, as a rule, of 55 per cent of orthotoluidine and 45 per cent of paratoluidine. The quantity of aniline added to this crude toluidine in order to produce the aniline for red varies according to the recipes of various manufacturers. As a rule about half the weight is used.

Theoretically, an oil containing equal molecules of the three bases would be required; but for practical work an excess of aniline and orthotoluidine is used, because a part of these two compounds escapes the reaction, while the paratoluidine is entirely used up.

Many methods in the course of the past have been proposed for oxidizing this mixture into aniline red, but only two have survived. They are known as the "arsenic acid melt" and the nitrobenzene process. From a practical point of view they are of equal value, but the arsenic acid melt is being abandoned on account of the poisonous nature of the arsenic compounds required and I shall not discuss it in this article because, in any case, the nitrobenzene process is the only process which interests us in this present discussion and which, as I shall show, has a direct bearing on the "pinking" of white canvas shoes.

In 1869 Couper discovered his process for producing aniline red, or fuchsine, or magenta, as it is variously called, by the nitrobenzene process. It did not give very good results at first, but was gradually worked out by various firms until successful, and at this writing this nitrobenzene process has practically superseded the one with arsenic acid.

It was originally supposed that the nitrobenzene used in this process enters into the aniline so formed, after having served as an oxidizer. At present it is generally recognized that the nitrobenzene merely acts as an oxidizing agent, and that, in so doing, it is transformed into tarry matters which are useless and remain in the residues.

The process is worked with different proportions and in a different manner in different manufactories, but in all cases it is based upon the following facts: Aniline and nitrobenzene do not react upon each other, nor does any reaction take place if aniline chloride be added. But if a small quantity of iron chloride be present, a reaction sets in at a temperature of 160 degrees. If the aniline and aniline salt used are pure, a color of the indulin group is obtained which is blue; but if paratoluidine and orthotoluidine be present in the necessary proportions—and they invariably are in nitrobenzene, or oil of myrbane as it is usually called—the result is pink.

I have been somewhat technical and prolix and long-winded in discussing all these minute and somewhat

dry chemical details because I wish the readers to see from all the various angles and viewpoints how it may be quite possible for mixtures of anilines and toluenes and the fumes from these compounds under favorable conditions—chemical and physical—to combine with the oxide of iron and ferrocyanide which are always present in Prussian blue and impart a pink or reddish color to bleached cotton goods which may have been blued with it in the finishing process.

PRUSSIAN BLUE (FERRIC-FERROCYANIDE)

Cyanides are compounds of the radicle Cyanogen CN. The history of the cyanide industry begins with the discovery of Prussian blue by Diesbach in 1704. Prussian blue is a compound of iron and cyanogen.

When cold neutral solutions of one molecule of a ferric salt and one molecule of potassium ferrocyanide are mixed together it will be found that a heavy precipitate of ordinary soluble Prussian blue is formed. The same compound is formed by mixing equal molecular quantities of a ferrous salt and potassium ferricyanide.

When a cold solution of potassium ferrocyanide is added gradually to a cold neutral solution containing an excess of a ferric or of a ferrous salt, or when a soluble Prussian blue is digested with a solution of a ferric-chloride, precipitates are found which, after a prolonged exposure to air involved in washing them completely, are identical in composition and properties. The substance when dried is normal ferric-ferrocyanide, usually referred to as Prussian blue. Turnbull's blue, obtained by precipitating a solution of ferric-cyanide of potassium with an excess of a ferrous salt, is identical with ordinary Prussian blue.

Both the soluble and insoluble Prussian blue, just described, are ferric-ferrocyanides and not ferrous ferric-cyanides. This is proved by the fact that they can be made by the action of hydrogen peroxide on a solution containing a ferric salt and potassium ferricyanide in suitable quantities; hydrogen peroxide reduced ferricyanide to ferrocyanide, but has no action on a ferric salt, so that ferrous ferricyanide could not be produced by this reaction.

Commercial Prussian blues as sold are not quite identical with those just described, but are mostly obtained by the oxidation of ferrous ferrocyanides. One class is made by adding a cold neutral solution of one molecule of potassium ferrocyanide, and then oxidizing the white precipitate by means of atmospheric oxygen, which is greedily absorbed. This blue is known as Hoffman's blue and is insoluble in oxalic acid. Another is to proceed as in the method given except that the solutions contain 1 per cent of sulphuric acid and a white precipitate is obtained which is much more difficult to oxidize than in the other case and possesses rather different properties. Like ordi-

nary soluble Prussian blue, it is soluble in water and oxalic acid, but it differs from it in being much more stable to ammonia solution and other alkaline influences. This is the blue usually found in a liquid state in commerce and is usually referred to as "stable soluble blue" and is the blue mostly used.

It will be of the first interest for us to know that precipitation from hot acid solutions always tends to produce blues of a more stable type, and also that the blue iron cyanogen compounds contain both ferric and ferrous iron. This is important to remember, as will be seen later. The compounds which contain only ferrous or only ferric iron are colorless, or—at least as compared with the fully developed blue—only feebly colored.

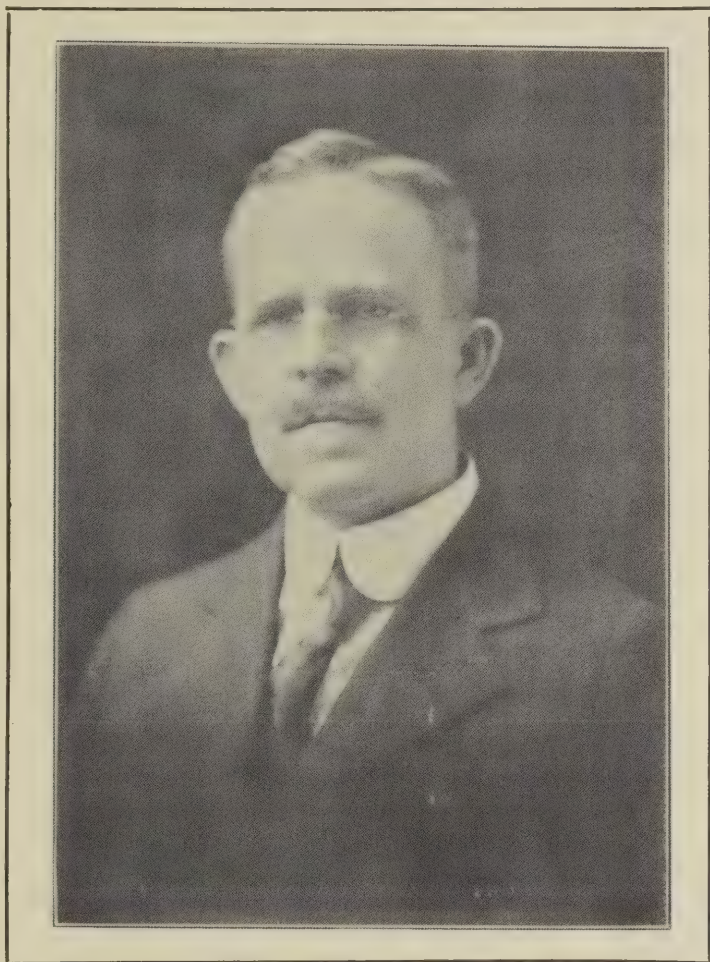
Potassium, sodium and calcium hydroxides, and ammonia, and heat coupled with moisture decompose Prussian blue into ferric-hydroxide and a ferrocyanide. Alkali carbonates act in the same way but more slowly. Goods blued with Prussian blue lose their color in the sunlight but regain it largely in the dark.

The liquid Prussian blues of commerce are usually mixtures of the compounds already described; the best blues are obtained by precipitating a ferrous salt with yellow prussiate and then oxidizing the precipitate. The finest quality is made about as follows: 50 kilos of yellow prussiate (ferrocyanide of potassium) are dissolved in 250 kilos of boiling water; 42.5 to 45 kilos of green vitriol (copperas) are dissolved in about the same quantity of water in the presence of some strips of hoop iron, or some kind of scrap iron (this is necessary to keep the copperas in the condition of a protosalt so as to prevent the formation of a ferric salt. The clear solutions are then run simultaneously into 250 kilos of clear water. The almost white precipitate is allowed to settle, and is then drained and filtered through a cloth filter. It is then transferred to a wooden tub and treated with 25.5 kilos nitric acid (specific gravity 1.23) and 18 kilos of sulphuric acid (1.84 specific gravity). Sometimes red fumes are evolved only after some hours, but if the copperas is in excess they are usually evolved at once and this gives the best color. After standing for twenty-four hours the mixture is suspended in a large quantity of cold water and allowed to settle. The supernatant water is then decanted off and the Prussian blue paste must be washed in several waters until the blue is free of acid.

Usually, however, the heated paste is treated with ferric-chloride in the place of the nitric acid, and sometimes the blue paste is acidified with hydrochloric acid and then chlorine gas is passed through it; this last is the cheapest method and therefore the one mostly used, no doubt. But in any case the result is the same, the solution or paste being oxidized from a ferrous into a ferric condition and the blue is developed.—*Cotton*.

MEN OF MARK

in the Dyestuff Field



George A. Moran

Chief Chemist

Pacific Mills

Lawrence, Mass.

GEORGE A. MORAN was born in the town of Framingham, Mass., and received his preliminary education in the public schools and high school of that town. He then attended the Massachusetts Institute of Technology and graduated therefrom in the class of 1897. After graduation he entered the employ of the Dunnell Print Works, at Pawtucket, where he worked under Dr. Emil Furneaux, who is now head of the research department of the Calico Printers' combine in England. Two years later he accepted a position with the Pacific Mills, with which concern he has been associated up to the present time.

During the first ten years he worked under the direction of the late John Alden, being occupied largely with research work on various textile problems. In 1909, when the Pacific Mills took over the Cocheco Manufacturing Company, of Dover, N. H., he assumed charge of the chemical department of that branch and remained there four years, until the new print works in South Lawrence combined the two old plants, when he returned to Lawrence. On the death of Mr. Alden, in March, 1916, Mr. Moran succeeded him as chief chemist for the Pacific Mills, which position he still holds.

The general plan of the chemical department under Mr. Moran's direction has been to combine both control and research work. While the opportunities for fundamental research work are not as great in a textile laboratory as in the laboratories of certain chemical manufacturing plants, Mr. Moran's organization has nevertheless been able to do much creative work along the lines of developing the use of new materials and in increasing efficiency by improving manufacturing methods, thus reducing costs and producing superior manufactured products.

While war conditions existed, the textile chemist was called upon to produce immediate results and had to depend largely upon knowledge and resources already at hand. With very few exceptions Mr. Moran's department was able to meet every war-time demand with reasonably satisfactory results. Mr. Moran says that the calls of war practically disrupted his organization but that it is now being rapidly reorganized to meet the public demand for textile fabrics of higher class than were ever called for before the war. To adequately satisfy this demand, however, extensive research is essential.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

N. K. M.—*Question*—In dyeing foxskins we understand alum is used. Is this for the purpose of curing the skin, or it is a part of the dyeing operation?

Answer—Alum is rubbed on the back of the skin with salt for the purpose of curing the skin, but there is also a necessity to dissolve alum with the dye, it acting as a mordant and fixing the color. The treatment with salt and alum will cure fox or any kind of skins, but fancy furs are generally dyed with a special class of fur dyes similar to the pre-war "Ursols." Full particulars as to the use of these may be obtained from the firms selling them. Fur dyeing is one of the highly skilled professions and must be learned from an expert.

O. C. W. Co.—*Question*—Can you advise us if any American manufacturer is producing Erika Pink? If not, will you give us your opinion as to what are the most similar products now available?

Answer—So far as we know, no American manufacturer is producing anything exactly identical with the pre-war Erika Pink. We believe that Erie Pink 2B, manufactured by the National Aniline & Chemical Company, or Newport Direct Pink 2B would probably meet your requirements.

B. K. S.—*Question*—I am sending you, under separate cover, a sample of dye. I find that this dye gives the tests of an acid dye, but another laboratory reports it as being basic. If I am wrong I will be glad to acknowledge it, but want to know just what tests would identify this dye. On adding BaCl_2 to its solution I get a precipitate, and with tannic acid I do not get one. When a solution of this dye is mixed with safranin a precipitate also results; so these tests led me to think that it was acid.

Answer—The sample of dyestuff referred to proves, upon examination, to be Soluble Blue—an acid color. Your deduction was quite correct from the experiments performed, and we fail to understand how another laboratory could have reported it as basic.

O. D. W.—*Question*—We enclose a sample of raw imitation georgette. Could you please advise us whether you know of any process that will take off the luster on such goods after the finishing, exclusive of the process

generally used through the trade, in which salts of barium are employed? This process could be used either in the dyeing or the finishing of the goods.

Answer—The sample submitted shows, upon examination, that it is composed of silk threads with comparatively little twist. It is nearer a chiffon than a georgette. The effect of the regular boil-off is to clean and brighten the fibers and, of course, to give the full luster to the silk. In a true georgette the threads are twisted as tightly as possible and alternate right and left twists in both warp and filling. When georgette is boiled off none of the silk fibers lie parallel and, consequently, we do not see the sheen of the silk as we would in a satin, for instance. In this case the only way to get the effect is to dull the fibers themselves. You have mentioned that this is done with barium salts, and many other white precipitates would have the same effect but be equally troublesome and uncertain. We suggest that you follow the same procedure that skein silk dyers use in dyeing dulls or souples, and not boil off with soap or sulphonated oil but use tartaric acid. This makes the silk flexible but leaves much of the gum on the surface in a fine powdery form, and gives a dull effect instead of a luster. This treatment will not interfere with the dyeing or weighting, and is not likely to tender the fabric.

S. M. Co.—*Question*—We would greatly appreciate any information you could give us as to what use Paranitro Benzoic Acid can be put to commercially. We believe it can be used as an intermediate in the production of some dyes.

Answer—This product can be employed in the form of an ester in the preparation of certain of the Novocaine series of local anesthetics, and is used to a limited extent in the manufacture of synthetic perfumes and flavoring extracts. It has no use as an intermediate in the manufacture of dyestuffs, so far as we are aware.

U. Y. Co.—*Question*—We are interested in getting as much information as possible regarding Benzaldehyde and would be grateful to you if you will give us the data you have on this particular subject, together with a list of books and periodicals dealing with it and its uses commercially.

Answer—Chemically, Benzaldehyde or Oil of Bitter Almond is one of the aliphatic aldehydes and is obtained by distilling a salt of benzoic acid with a salt of formic acid, and also by heating benzalchloride with water. The reaction obtained by this latter method is as follows:



This is the laboratory method of preparing the artificial variety. Benzaldehyde is a colorless liquid, boiling at 180 deg. Cent and giving all the characteristic reactions of the aldehydes. We regret to say that there is very little literature bearing on this product and its commercial applications. As you probably know, it is employed as an intermediate in the manufacture of a large number of aniline colors, including Malachite Green, Brilliant Green, Patent Blue, Victoria Green, etc.

Review of Recent Literature

"The Testing of Dyestuffs in the Laboratory"; C. M. Whittaker, B.Sc.; 98 pages, 6 x 10; Heywood & Co., Ltd., 150 Holborn Street, London, England.

To provide dyeing chemists, students and the ever-increasing number of coal-tar research chemists with a knowledge of methods for determining the possible utility of the results of their researches is among the aims of this comprehensive and compact work from one who needs no introduction to the trade, either here or abroad, and whose long experience as head of the experimental dyehouse of Read Holliday & Sons, Ltd., now the British Dyestuffs Corporation, well equips him to view the numberless varying methods of testing and handling dyes from a strictly utilitarian standpoint. The methods described were developed during twenty years spent in dealing in the laboratory with the testing and application of all classes of dyestuffs for the general purposes of dyeing, exclusive of calico printing and lake making, and are not laid down in a dogmatic manner, because, as the author declares, they are always being improved as experience accumulates and he is well aware that other colorists use other methods with equal success in attaining the object in view.

It may be thought that the compilation of a book dealing with the testing of dyestuffs in the laboratory will be superfluous in view of the numerous books on dyeing already available; but small-scale dyeing, of course, differs in many ways from large-scale operations, so that a book dealing specifically with the former should fill a distinct gap in our present literature. Dyeing on the laboratory scale is often considered a simple matter, for which no special training is required; but as a matter of fact no one is successful in laboratory dyeing unless he works with extreme accuracy and possesses keen powers of observation. The author contends that laboratory, or "pint pot," dyeing has often been treated with great contempt by many who should have known better, and that the antagonism of some dyers is one of the greatest difficulties which the dyehouse chemist has to face. He prefaces to the present work the opinion that the greater the antagonism shown by a dyer the cruder are the methods of that dyer; in other words, the greater the antagonism the greater the ignorance. Dyeing with vat

dyestuffs, he holds, may be put forward as a striking instance of the fact that the foundations of modern dyeing were laid in the dyeing laboratory. The fusion of beta amido-anthraquinone with caustic potash to yield an insoluble blue compound was a comparatively simple and routine chemical operation, but the chemist who worked out the unusual dyeing process so as to obtain from this insoluble blue body one of the fastest dyestuffs extant, known commercially as Indanthrene Blue RS, is the one to whom a large part of the credit should be given.

After a preliminary chapter on the dyestuff testing laboratory and its functions, with attention to general lay-out, working conditions, equipment, storage of type dyestuffs and the difficulties of small-scale dyeing, there follow chapters devoted to the testing of acid dyestuffs, the insoluble azo dyestuffs, basic dyestuffs, mordant dyestuffs, direct cotton dyestuffs (including those which develop), sulphur dyestuffs, vat dyestuffs and the dyeing of mixed fabrics. The final chapter treats of the money valuation of dyestuffs, subdivided as follows: Identification of Dyestuffs; Basic Dyestuffs; Direct Cotton Dyestuffs; Sulphur Dyestuffs; Aniline Black; Logwood Black; Turkey Red; Insoluble Azo Dyes; Indigo; Catechu Brown; Distinguishing Tests Between Xylidine and Croceine Scarlets; Mordant Dyestuffs; Potting Blacks; Vat Dyestuffs; Fiber Tests; Distinction Between Mulberry and Tussah Silk; Tin-Weighted Silk; Test for Mercerized Cotton; Distinction Between Jute and Hemp; Amount of Cotton in Mixed Fabrics; Animal and Vegetable Fibers; Distinction Between Silk, Cotton and Wool; Distinction Between Natural and Artificial Silk; Distinction Between Different Varieties of Artificial Silk.

The work is intensely practical, contains many valuable hints, and should prove a useful addition to the literature on laboratory control of the dyehouse.

Practical Trade Mathematics; James A. Moyer and Charles H. Sampson, B.S.; 172 pages, 5x7; John Wiley & Sons; \$1.50.

This book was written because of the need for a text on mathematics suitable for students specializing in the various trades. The method of treatment holds the student's interests, taking up the problems of the day's work and presenting only those parts of the commonly used mathematical subjects that are likely to be encountered. The problems are in two groups, first, those for electricians, and second, those for the other trades.

The contents are grouped under the following titles: The Use of Numbers; Simple Measures; Common Factors and Their Application; Decimal Fractions and Their Application—The Circle; Percentage—Practically Applied; Rates and Proportion; Powers of Numbers; Roots of Numbers; Problems of Industrial Appliances and Power; Practical Applications of Geometry; Practical Applications of Solid Geometry; The Use of Tables and Curves; General Review.

AMERICAN DYE STUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL 8, NO. 6
FEB. 7, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

In Part II of their paper on "Laboratory Experiments in Rendering Dyes on Textiles Fast to Sunlight," Frederic Dannenrth, Ph.D., and Kurt Gebhard, Ph.D., describe various processes designed to accomplish this purpose.

In the second instalment of his article on "The Technology of Chrome-Tanned Upper Leather," William C. Jackson describes the treatment of the hides preliminary to dyeing and finishing.

George Najar, of the Monument Mills, gives the results of his experience in "The Bleaching of Cotton Warps."

Giles Low, of the Newport Chemical Works, suggests more careful terminology when referring to color, in an article entitled "About That Word 'Shade'."

Walter E. Hadley describes simple methods for determining the strength of Meta-Toluylenediamine.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 8, No. 6

NEW YORK, FEBRUARY 7, 1921

Section 2

Technology of Chrome-Tanned Upper Leather—Part II

By WILLIAM CLARK JACKSON

Colicrist with J. S. Barnet & Sons, Inc., Lynn, Mass.

LIMING

DUE to the various classes of leather made, in all of which the liming plays such an important part, no definite rules can be laid down for a liming process—that must be determined entirely by conditions; but possibly a few explanatory notes on the actions of various liming methods may be helpful.

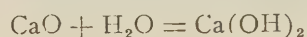
Sodium sulphide is now generally used with the lime to destroy the hair roots and epidermis. It has very little effect on the hide substance, and especially the cementing substance. A common mistake is to increase the sulphide to excessive quantities if the fine hairs are too much in evidence; whereas, if the size of the packs were cut down a little, thereby giving the lime and sulphide a better opportunity to reach the roots of the hair, the trouble might be quickly overcome, because hydrate of lime is soluble only to the extent of $1\frac{1}{4}$ ounces to a cubic foot of water and as fast as the stock absorbs the lime there should be plenty of liquor present, from which more lime may be dissolved; if the stock is packed too tightly this will not be the case. An excessive use of sulphide, especially on calfskins, has a tendency to make the fat wrinkles more pronounced and to give the stock a greener cast, and appears as a mottle on the flanks and bellies; this may later affect the shades in the coloring process.

In the winter months the days of liming may have to be increased, unless the temperature of the lime-yard is kept at summer heat. The temperature of the limes should be kept constant at about 65 deg. Fahr. to obtain uniform results, and this is better obtained by keeping the whole yard warm than by heating the individual limes.

CHEMICAL REACTIONS IN LIMING

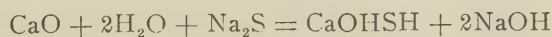
Quicklime, CaO , when treated with water is converted into calcium hydrate, Ca(OH)_2 , and is best

prepared by slaking the lime in a large shallow tank by throwing enough water on it to thoroughly wet it and allow it to heat for twenty-four hours, and then adding enough water to make a thick paste—



By knowing the quantity of quicklime taken and the capacity in gallons of the tank, it is an easy matter to compute the number of pails of paste required to each lime pit. This paste should be put in a barrel and thinned down with water and added to the pit.

The sodium sulphide may be slaked with the lime, in which case it combines chemically with some of the calcium oxide—



When sodium sulphide is dissolved separately it hydrolyzes, forming caustic soda and sodium sulphhydrate—

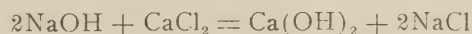


which, when added to the slaked lime, reacts as follows:



In either case the chemical result is the same.

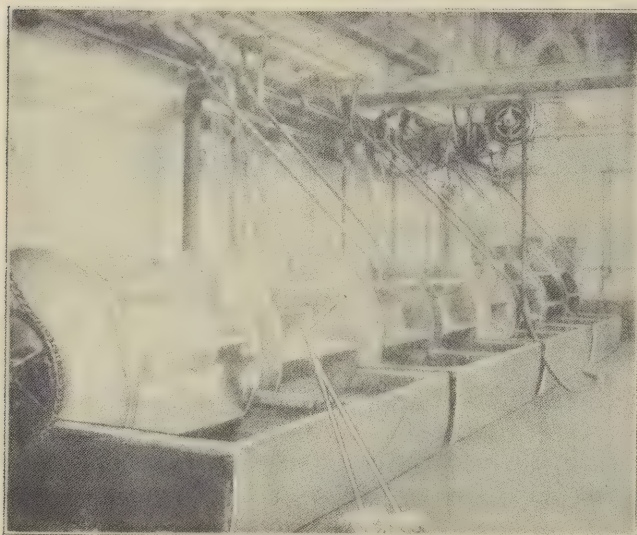
If in case the grain is swollen too much from an excessive amount of sulphide, due to too much caustic soda being formed, it may be lessened by adding an equivalent amount of calcium chloride, which will convert the caustic soda into hydrate of lime and common salt—



METHODS OF LIMING

Many prefer to start the stock in a plain weak lime

and on each successive day sharpen it with more lime and sulphide. It is wholly a case of which method appears to give the best results. The amounts of lime and sulphide to use and when to be added are governed entirely by the character of stock used and the results to be obtained.



Paddle Vats

Chas. H. Stehling Co., Milwaukee, Wis.

For certain classes of leather, such as patent and blacks, sodium sulphide with very little lime is sometimes used, and in this method caustic soda is the depilatory agent; but care must be taken that all the caustic is washed out or neutralized before the stock leaves the beam house. This method is unsatisfactory for colors, as the hair alone is destroyed, leaving the hair roots and pigment in the skin, which naturally gives a very unsatisfactory base for coloring.

Liming may be done either in pits (still limes) or in paddles. In still limes the stock must be hauled out each day and the lime plunged thoroughly and the stock put back. In paddle liming the paddles should be turned for a few minutes frequently to change the position of the stock and to stir up the lime.

RENEWAL OF LIMES

A point of great importance is the number of times a lime should be used before starting a new one. A very good plan is to run through a certain number of packs—say, for calfskins, three—and then put the fourth pack in the old lime for the first day, and on the second day haul out and thoroughly clean the pit and put the stock back into a new lime, adding more lime and sulphide on the third day.

A new lime has a tendency to give the stock a harsh grain, which is overcome by using the old lime the first day. Stock from old limes will unhair easier, swell better and give softer leather, due to the ammonia present, which has a strong solvent and un-

hairing power. A new lime is sterile, whereas an old one, containing a high percentage of animal matter and gelatin, furnishes an excellent medium, in which bacteria will grow, which produce liquefying ferments that dissolve the hide substance and naturally yield looser leather.

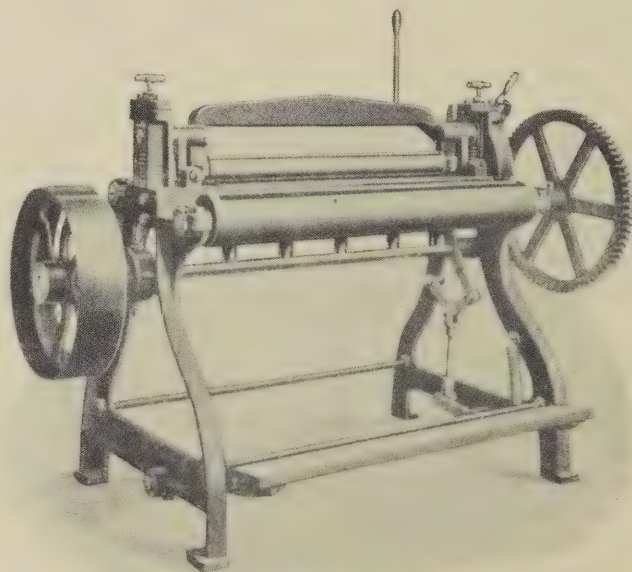
Thus it is shown that to produce satisfactory results the liming process must be controlled either by changing the lime at a specified time or by means of quantitative tests for ammonia and gelatin, changing when a certain percentage is reached.

FATS

There are two distinct classes of fats present in hides, one consisting chiefly of cholesteryl and liquid waxes, which are present in the epidermis and are largely unsaponifiable. These are removed by the unhairing process. The other class, containing triglycerides of olein, stearin and palmitin, are readily converted into insoluble lime soaps, which remain as such. If the stock is too low limed, these fats are not thoroughly saponified and show up in the finished leather as dark, greasy spots.

DEPILATION

When the hair is sufficiently loosened to come off readily, the stock is pulled out of the lime and un-



Cheeking Machine

Turner Tanning Machinery Co.

haired by machine and washed in an open drum to take off the surface lime, dirt, etc.

The cheeks are then split to the proper gauge on a cheeking machine, which is similar to a union splitter. The stock is next fleshed by machine, and at this stage much fat, lime and loose flesh are removed.

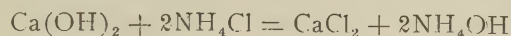
The skins are now put in tepid water preparatory to being worked over the beam with the beam knife. This is a very important part of the process, as it is here that the remaining short hairs must be removed and the fat glands and dirt are also worked out of the grain, together with considerable lime. It is important to keep the stock under water as much as possible after coming out of the lime, as the action of the carbonic acid in the air forms carbonate of lime or chalk, which causes uneven results later.

BATING

The object of bating is twofold: firstly, to neutralize and remove the remaining caustic lime and soda, which is accomplished by forming soluble calcium and sodium salts; secondly, to produce a soft, pliable leather, which is obtained by a putrefactive or fermenting process that has the effect of reducing the plumpness of the stock and also of softening it by its solvent action on the fibrous tissue.

These results may be obtained by the use of hen, pigeon or dog manure, or by using an artificial, chemical and bacterial bate. The manure bate is dirty, foul-smelling and not uniform, and is governed by "rule of thumb"; whereas, in an artificial bate the same chemical result is obtained, the stock coming out much cleaner, and when understood and handled properly better results can be obtained.

With a manure bate the lime is neutralized by the organic acids present, and the soft, silky grain is obtained by the action of the putrefactive ferments. With an artificial bate, such as "Oropon," the active neutralizing agent is ammonium chloride and the chemical reaction is ideal, forming calcium chloride and ammonia—



The putrefactive ferment is a small quantity of the pancreatic juice mixed with pulp, which has the desired effect on the grain. After the stock is sufficiently "down," which is determined entirely by appearance and "feel," it is pulled out, rinsed and then pickled in salt and sulphuric acid to stop the putrefactive fermentation, as the presence of acid is fatal to this class of ferments.

PICKLING

Pickling may be done either in paddles or drums. In paddles much more salt is necessary on account of the increased quantity of water, and is best governed by the use of a Twaddle glass. The acid is determined by the weight of the stock. A paddle pickle may be used several times. For uniform results the drum pickle is better, making a fresh pickle for each load.

The acid is the active agent and if used alone will swell the grain, and to overcome this swelling salt is added in about the proportion of eight parts of salt to one part of acid by weight and 10 gallons of water to 100 pounds of stock for drum pickling. Stock pickled lightly will not mold after being tanned as readily as will stock with a heavy pickle.

SUMMARY

The process to this point has been of a destructive nature, and the swelling and falling which the fibrous tissues have undergone, due to the action of the various reagents, is closely allied to osmosis and is both physical and chemical in its nature. The main object has been to eliminate the impervious substances of the grain and leave the fibers in a more or less open condition, that the materials added in the subsequent operations may be more readily absorbed.

(To be continued.)

Laboratory Experiments in Rendering Dyes on Textiles Fast to Sunlight—Part II

In Which Methods for Increasing the Fastness to Light of Dyed Fabrics Are Discussed

By FREDERIC DANNER, Ph.D.

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In collaboration with Kurt Gebhard, Ph.D.

1. THE USE OF METALLIC SALTS

IF it is desired to protect certain molecular groups in a dye and these groups possess the ability to form addition products with metallic salts, it is possible to use a simple method of after-treatment, such as that with copper sulphate. In most cases, however, such metallic salts produce the best effects if they are capable of forming inner-complex salts with the dye. For example, it has been noted that the

ortho-oxyazo dyes form colorings of special light fastness when they are after-treated with these metallic salts (A). The formation of complex salts is in itself, however, not sufficient, the chemical character of the metal and the acid radical of the dye being important factors. Copper-nitrate, -chloride, -sulphate, -chlorate and cuprous bromide are the most important salts used. Copper chlorate appears to be best adapted of all for increasing light fastness. This is especially

noticeable in the case of Dianil Pure Blue PH (Badische). In the matter of the acid radical it will be recalled that acetic acid is added to the copper sulphate after-treatment bath in order to prevent separation of copper hydroxide.

If the dyes, because of their constitution, cannot combine with metallic salts it is sometimes possible to increase the fastness by applying the metallic salts in the form of a complex compound. *The ammonium compounds of copper and nickel* are of value in the after-treatment of direct and vat dyes on cotton. They attain to their maximum efficiency in most cases if they are subsequently treated in a soap bath. The strongly positive metal-ammonium complex possesses little affinity for dyes of certain chemical groups, so that its application as a stabilizing agent is limited. In certain cases it is necessary to render the metal-ammonium complex less electro-positive, or even electro-negative. This can be accomplished by the addition of sodium nitrite. Example: Helindon Green can be improved to a marked extent by nickel sulphate + ammonia + sodium nitrite. In this case nickel sulphate + ammonia does not improve the light fastness to any important degree.

Helindon Scarlet S shows the same results as Helindon Green. On the other hand, Fuchsin dyed on a tannin-mordanted cotton could not be improved by an after-treatment with nickel sulphate + ammonia + sodium nitrite. In this case nickel sulphate + ammonia gave good results.

Dyes of the type of Malachite Green cannot be improved in fastness by either of these after-treatments. The color changed to a dirty green shade, from which one may conclude that the saturation of the ionized valence has taken place only in the auxochrome. Very good results were obtained by an after-treatment with copper sulphate + ammonia + Turkey red oil.

Fuchsin O, Janus Black and Dianil Black can be improved by an after-treatment such as that just mentioned. This method bears a close resemblance to the alizarin-lime-aluminum-Turkey red oil process. Pale colors, such as Rhodamin O, are rendered dull by this treatment; but this can be overcome by substituting zinc for copper.

Malachite Green dyed on a tannin-antimony mordant can be improved by an after-treatment with copper ferrocyanide + ammonia + Turkey red oil. Here we have a case where it is important that the several component parts be mixed in a certain sequence. It is necessary to add the Turkey red oil to the copper oxide-ammonia solution. Potassium ferrocyanide is then added to this mixture. Experience has shown that solutions prepared in the order copper ferrocyanide, ammonia, Turkey red oil, or the other sequence, copper oxide-ammonia, potassium ferrocyanide, Turkey red oil, are of little value for increasing the sun fastness of Malachite Green.

The pungent character of ammonia vapors makes it quite impossible to work in open barks with large

quantities of cupro-ammonium solutions. Experiments were therefore carried along the line of substituting alkaline glycerol solutions for the ammonium. It was observed that complex compounds could be obtained, but the light fastness was not increased to any material extent.

The zinc poly-glycosate described by Grabowsky in German Patents 139954 and 141508 was tried out, but no valuable results were obtained. Borax was tried out without the addition of metallic salts, and was found to be of value in some cases. Dianil Pure Blue PH and Brilliant Benzo Violet B were improved by this treatment. Sodium carbonate did not yield positive results, from which we must conclude that the action of borax depends rather on its complex constitution than on its alkaline properties. Another way of avoiding the use of ammonia consists in replacing the Turkey red oil by such organic substances as form soluble compounds with copper salts.

In developing this method, sodium salts of aliphatic oxy-acids were used. The colorings obtained are not fast to washing; it must, however, be noted that addition products are formed, as the colorings produced were fast to light at temperatures as high as 80 deg. Cent. The oxy-acids tried out included citric, tartaric, glycolic, lactic, quinic and dioxy-tartaric. The best results were obtained with the use of citric, malic and tartaric acids. The metallic salts which yielded the best results in combination with these oxy-acids are copper salts, cerium sulphate, ferrous sulphate, aluminum sulphate and zinc chloride. The metallic salts used for the after-treatment should therefore be chosen with reference to the chemical character of the groups which are to be protected. For example: If it is necessary to protect active hydrogen atoms, aluminum sulphate and zinc chloride would be chosen.

The light fastness of many colorings on cotton can be increased to a marked extent by this after-treatment with metals and the sodium salts of oxy-acids. Positive results were obtained with Dianil Pure Blue PH, Brilliant Benzo Violet B, Dianil Green G, Malachite Green, Rhodamin O, Fuchsin O.

In the case of Dianil Pure Blue PH and Brilliant Benzo Violet B good results were obtained by the use of magnesium-boron-citrate. The after-treatment proposed by Geigy, using glucose and copper sulphate, was not tried out. Metallic salts are also capable of yielding complex compounds with amido acids, and these compounds increase the light fastness of many dyes.

*Table Showing the Results Obtained by
Glycocol After-treatments*

Dianil Pure Blue PH—

Glycocol	N. G.
Glycocol; copper sulphate.....	N. G.
Glycocol; aluminum sulphate.....	Very good
Glycocol; zinc chloride.....	Very good
Glycocol; chromium chloride.....	Good

Brilliant Benzo Violet B—

Glycocoll	N. G.
Glycocoll; copper sulphate.....	Slightly
Glycocoll; aluminum sulphate.....	Slightly
Glycocoll; zinc chloride.....	Very good
Glycocoll; chromium chloride.....	Slightly

Malachite Green—

Glycocoll	Slightly
Glycocoll; copper sulphate.....	Slightly
Glycocoll; aluminum sulphate.....	Very good
Glycocoll; zinc chloride.....	Very good
Glycocoll; chromium chloride.....	Very good

Glycocoll apparently reacts with “*active nuclear hydrogen atoms*,” and we may conclude that this is a case of the previously noticed primary addition to active hydrogen atoms. It is worth noting that copper sulphate, which in most cases has a favorable effect on light-fastness, is quite impotent in this case. On the other hand, zinc chloride and aluminum sulphate, which are usually used for condensations, do in this case exercise a remarkable influence for good.

Complex iron compounds also deserve special mention, as one of them occurs in a special form in “*Saech-sicher Gruenerde*.” The Malachite Green lake produced with its aid is exceptionally light-fast. If the iron be removed from the “earth” by means of hydrochloric acid, the material is no longer capable of rendering Malachite Green light-fast. No laboratory product which can replace this “earth” has yet been prepared. Weinland (*Berichte*, 1912; page 1113) described the iron compound of ortho-dioxy-benzene (pyro catechin), which increases the light-fastness but at the same time dulls the shade to a considerable extent. The same is true of ferrous sulphate, ferric benzoate and ferric phenolate. (In this connection see also *Berichte*, 1912; pages 2662 and 2498.)

A compound consisting of pyrocatechin, magnesium chloride and iron $(\text{C COO})_3$ and as much sodium hydroxide as would be required for the mono-sodium salt of pyrocatechin was prepared. This substance is deep black and has a strong affinity for cotton. The cotton may be padded at ordinary temperatures and then dried. Colorings fast to washing are obtained, and the fastness to soaping may be increased by a copper after-treatment. The fastness to light is good even without this after-treatment.

All the metallic compounds which are of value for increasing light-fastness are usually present on the fiber as metallic compounds and not as basic oxides but if the production of a basic oxide is superinduced the light-fastness is increased. It is interesting to note in this connection that the chlorophyll contained in living plants is very fast to light, while the alcoholic solution of this substance is quite sensitive to the ultra-violet solar rays.

2. THE USE OF OXY-ACIDS FOR AFTER-TREATMENT

The favorable results obtained by the use of oxy-acids in the presence of metallic salts is in many cases

observed in the absence of metallic salts. In that case the oxy-acids act as a “bridge,” or else they protect active hydrogen atoms in the previously mentioned manner. (Oxy-acids are changed to aldehydes when exposed to photochemic rays, but the *aldehydes* apparently *do not* enter into consideration in the fading process, as experiments carried out with aldehyde did not yield any positive results.) The light-fastness of Rhodamin S, 3B, 6G, G, O, Fuchsin O, Malachite Green, Victoria Blue R, Flavo-Phosphin G, Rhodamin Ponceau S, Dianil Pure Blue PH, Brilliant Benzo Violet B was increased by treatment with sodium citrate and sodium tartrate. The sun-fastness of Helindon Green was increased by sodium oxy-cinnamate.

3. THE USE OF UREA AND THIO-UREA

The use of these substances likewise depends upon the formation of addition products. Thio-urea is especially adapted for binding the ionized valence of a dye because of the unsaturated character of the sulphur which is contained in its molecule. Dianil Pure Blue on cotton treated with thio-urea yielded good results. Malachite Green on tannin cotton treated with thio-urea yielded very good results. Helindon Yellow 3GN treated with diethyl-urea yielded good results. Helindon Yellow 3GN treated with diphenyl-urea yielded no useful results.

4. SODIUM MOLYBDATE, SODIUM PHOSPHO-TUNGSTATE, SODIUM PHOSPHITE

These compounds in many cases form very stable addition products and “complex” compounds. It would therefore seem that they should be useful for after-treatments. This has been found to be the case, but only a small number of dyes yield to this treatment. Sodium molybdate increased the sun-fastness of Dianil Pure Blue PH on cotton, and Malachite Green on tannin antimony mordanted cotton.

Sodium tungstate yielded less valuable results.

Sodium phospho-tungstate was likewise found to be less active than Na molybdate.

Phospho-tungstic acid was found to be an excellent “bridge” member for Malachite Green; it increases the sun-fastness to a remarkable extent. Cotton treated with phospho-tungstic acid and then dyed with Malachite Green is colored somewhat weaker than ordinarily, but the colorings possess superior fastness to light. It is not necessary to mordant the cotton with phospho-tungstic acid. Good results are obtained by boiling the cotton in a bath containing the acid and the dye.

Ortho-phosphoric acid and its salts yielded no positive results.

Sodium phosphite and the other unsaturated phosphor-acids yielded good results, especially in the case of Dianil Pure Blue.

Sodium meta-phosphate was found to have a broad application.

5. THE USE OF META-PHOSPHORIC ACID AND ITS SALTS

This method has been published in German Patents 255117 and 257876. This acid and its esters form addition products with the amido groups and the imido group (*Berichte*, Vol. 44, page 2076; Vol. 26, page 1020; Vol. 43, page 1860). The acid is also capable of reacting with alcoholic hydroxyl groups. It is therefore well adapted for protecting individual groups and for acting as a "bridge" member. The chief objection to meta-phosphoric acid and its salts is its tendency to revert to ortho-phosphoric acid. The complex compound formed with the dye helps, however, to stabilize these substances by mutual saturation. The stability of the complex: Dye-fiber phosphate is increased to a big extent by the addition of glucose (see German Patent 257876). Method: Use meta-phosphate of soda, 10 grams, in 100 c.c. of water and add glucose, 10 grams, in 100 c.c. of water. Allow the phosphate solution to run into the glucose solution, and then neutralize with soda so that the solution is slightly alkaline to litmus.

The following dyes were applied to the fiber in the usual manner, and then after-treated with the solution just mentioned; the light-fastness was in all cases increased very decidedly: Rhodamin O, Dianil Red R, Victoria Blue B, R. Dianil Green G, Brilliant Benzo Violet B, Malachite Green, Dianil Pure Blue PH, Benzo Purpurin 10B, Dianil Red 4B, Flavo Phosphin S, Auramin O, Benzo Azurin 3R, Helindon Red B, Erika BN, Helindon Green S, Dianil Blue H6G, Fuchsin O and Salmon Red (Berlin, Schultz No. 120).

These experiments show that the meta-phosphates are well adapted for increasing light-fastness of many dyes on cotton, as the dyes mentioned belong to groups which differ widely in chemical constitution. It must be noted that very small changes in the constitution of the dye will render this method of after-treatment ineffective.

The light-fastness of Helindon Scarlet S can be improved, while that of Helindon Orange R is not affected. The latter dye contains the oxy-ethyl group in place of the thio-ethyl group of the first-named dye (SC_2H_5).

Naphthalene Red, a direct cotton color, cannot be improved in fastness by this method. The use of the meta-phosphate method in practice is limited because the products obtained are not fast to water. It might at most be used on fabrics which are not washed—furniture coverings and decorative fabrics. Attempts at rendering the complex sodium meta-phosphate dye insoluble by means of glue, calcium chloride, magnesium chloride, magnesium sulphate, albumin, Turkey red oil have not yielded positive results. The light-fastness was in each case improved, but the products obtained were not fast to washing. It should therefore be noted that the presence of these materials in connection with the meta-phosphate treatment does not destroy the sun-fast properties obtained by means

of meta-phosphate. This is of interest where fabrics are finished with any of the materials mentioned above.

6. SODIUM THIO-SULPHATE

The stabilizing action of this substance on dyes is noticed in only a few cases. Its advantages are cheapness and applicability to silk. It cannot at this time be said whether its value depends on its power of addition because of the unsaturated character of sulphur (NaO_2S). It may be due to a primary photo-chemic change, as in the case of sodium nitrite. The best results were obtained with Dianil Pure Blue PH on cotton and on silk. No positive results were obtained with Brilliant Benzo Violet B, Malachite Green and Rhodamin G, 6G, 3B. Rhodamin O and S were less light-fast after being treated.

7. SODIUM NITRITE

In a few cases, more especially in the case of vat dyes, the sun-fastness can be decidedly improved by after-treatment with sodium nitrite. This method is of little value for cotton, as that fiber is rendered quite tender by this substance. Baudisch (*Berichte*, Vol. 44, page 1909) has observed that when sodium nitrite is exposed to light, oxygen is split off and nitroxyl is formed. Both oxygen and nitroxyl act on the fiber, but their action can be diminished somewhat by the addition of glucose to the bath. It cannot be stated at this time just whether the light-stabilizing action of sodium nitrite depends on the addition of nitroxyl to the reactive groups of the dye, or if the product formed by the action of nitroxyl on cotton combines with the dye to form a light-fast compound.

Helindon Scarlet S, Helindon Yellow 3GM and Helindon Red B on cotton were decidedly improved in light-fastness by this treatment. Helindon Scarlet S is very sensitive to light, and yet its fastness was increased to an enormous extent by this after-treatment.

Helindon Scarlet R contains an oxy-ethyl group in place of the thio-ethyl group of Helindon Scarlet S, but its light-fastness was not increased. Most of the substantive and basic dyes could not be improved by after-treatment with sodium nitrite. The light-fastness of Brilliant Benzo Violet on cotton and that of Rosindulin 2G on wool was increased by this after-treatment.

New Blue R is destroyed by sodium nitrite when treated with this substance in the dark, but, curiously enough, this dye is stabilized by treatment with this substance in ordinary light.

8. DYESTUFFS

The complex: Dye-fiber can be rendered inactive by means of a second dye. There are a few cases of this on record, but one of these is of especial interest:

the combination of Flavanthrene with Indanthrene. Experiments were tried substituting other yellow vat dyes for Flavanthrene and substituting Indigo for Indanthrene, but no positive results were obtained. Brilliant Fast Blue B is very fast to light, but if Helindon Yellow 3GM be topped with Brilliant Fast Blue B a green shade is obtained, and this green shade is quite fugitive to light. Its fastness is similar to that of a shade obtained when Helindon Yellow 3GM is topped with Dianil Pure Blue PH.

About That Word "Shade"

A Plea for the Use of More Accurate Terminology

By GILES LOW

Newport Chemical Works, Inc.

THERE is no term in dyestuff parlance which is so much overworked or expected to mean more things than the word "shade."

In one single booklet of an American dye manufacturer we find these expressions:

1. "The shade will be duller when acid is used."
2. "Animal fibers are dyed a yellower shade."
3. ". . . a good shade of blue is produced."
4. ". . . a brilliant shade of orange."
5. ". . . may be shaded with an acid yellow."

Obviously it is a most versatile little word, but by that very attribute it is also a weak word, because its exact meaning cannot be conveyed unless one refers to the text to find out what it is all about. Perhaps a reform would hardly justify itself, but personally I insist that all of my assistants use a word which conveys the exact meaning when conversing with me about color; and I get a great deal of satisfaction out of it. The cause of the condition is half analyzed by so speaking. One "gets down to brass tacks," to use a rather inexplicit but well-understood comparison.

Let us take color "analytically" and words "synthetically" and see if we can improve our conversation. First, color is a sensation, just as sound is. Vibrations of certain wave-lengths do something to the organs in our ears and we have a sensation which we call hearing, and we call the vibration "sound." Another set of wave-lengths does something to the nerves in our eyes and we call it seeing, and "color" is what we see. Of course, we see "shape," too; but that is beside the point.

These color vibrations are produced in three ways: absorption, interference, and refraction. The last two are interesting to the physicist. Just now we are colorists, and the production of color by absorption is what we are interested in.

Everyone is familiar with what happens when we stick a glass prism into a ray of sunlight. The ray of light splits up into the colors of the rainbow (spectrum). It is a poor rule that doesn't work both ways, and this is a perfectly good rule. If all colors (in the form of light

rays) are converged into one ray, that ray is white; and if that ray is thrown onto a piece of wool dyed with roccelline, the wool will appear red. Nothing so remarkable about that, excepting that it illustrates what we are talking about—"absorption." The dye *absorbs* all of those rays which we just converged, excepting the red one, which it *reflects* against our eye, giving us the sensation which, for the sake of simplicity, we call seeing red.

Now, if this selfsame ray be directed against a dyeing of guinea green an entirely different sensation is produced—that of seeing green—because the red as well as all the other colors, excepting green, is absorbed. So if we made a dyeing of a mixture of these two colors the whole set of vibrations in that ray of light would be quenched or absorbed and, nothing being reflected, nothing would act on our eyes, and therefore we have *no* sensation and that condition we call seeing black.

If we have the sensation of seeing yellow and seeing blue at the same time (much the same phenomenon as hearing a chord on the piano) we "see green"; that is, we have the same or a very similar sensation to that produced when green light strikes our eyes. That is why mixtures of yellow and blue dyestuffs produce green dyeings.

HUE

In fact, all colors produced in this world ("American-made" or otherwise), excepting the spectrum, are mixtures. There are no *pure* colors; but there is always, of course, a *predominating color*. Let us call this the *hue* of that particular color. According to that, we would speak of a beautiful red *hue* rather than a beautiful red *shade*.

CAST

All colors being mixtures, there would be another color next in importance to the predominating one. Let us call this the *cast* of that color.

Thus we would say that Xylidine Scarlet was a color of a red hue with a yellow cast, not a yellow *shade* of red. Magenta is a color of a red hue with a bluish cast, not a blue *shade* of red, etc. By the "purity" or "purity" of a color we mean, or should mean, the lack of cast. That is, the less of the secondary color in the mixture the *purer* the predominating color and the nearer the approach to the spectrum standards (which, however, can never be reached).

TINT

We must understand, also, that the addition of either black or white to a color will affect its purity. If we add white to a color we get a "tint" of that color. Pink is a *tint* of red, lemon a *tint* of yellow, amethyst a *tint* of violet, etc. We ought not say that pink is a *shade* of red, etc.

SHADE

But now that we have the poor word down, let us not kick it but give it its due. When we add black to a color we can properly use the word shade. Maroon is

a shade of red; so are claret, garnet, russet and brown. Plum and puce are shades of violet. Olive is a shade of green, terra cotta a shade of orange, etc. These are very properly called *mode shades*. Of course, we could have tints of these shaded colors and, conversely, it should be permissible to speak of "shades of tints," which are nothing more than light colors to which gray has been added.

We speak of deep shades and light shades, by which we imply the use of more or less dyestuff. At this point theory and practice have a little falling-out, as they frequently do in this world. We cannot make a color weaker in practice without adding white. (I do not refer to the use of Glauber's salt but to the dyeing of white materials with lesser amounts of dyestuff.)

Therefore, by "light shades" all we can mean is "tints," or, technically, a "weak" or "light" dyeing.

A "deep shade" is a "heavy" dyeing.

By the word "tones" we mean the varying degrees from black through a color to white.

BRILLIANCY

One other quality of colors is their brightness or dullness. It refers to nothing but the comparative *amount of light* reflected by a color. It is possible by various scientific methods to determine this comparison, and it has been found that (of the spectrum colors) orange yellow is the most brilliant while violet is the least so. In mixed colors brilliancy would also be controlled by cast, intensity and tone.

Therefore it is possible for a variety of casts of the same hue to possess different degrees of brilliancy, so in some cases it would be quite correct to say bright shade or bright tint.

To sum up, a color has—

1. Hue—its predominating color.
2. Cast—its secondary color.
3. Brilliancy or dullness—the amount of light it reflects.
4. Intensity—strength or weakness.
5. Tone—the absence or presence of black.

And the word "shade" really only refers to the last half of the last quality.

As I intimated before, the word shade has been abused for so long that it is probably impossible to ever put it back where it belongs. But I have found that when trouble or discussion has arisen regarding certain results the mere use of the proper words has helped enormously in finding the method of correction.

[*Editor's Note: This subject of color terminology strikes us as most interesting and as one which, in most cases, has been overlooked by those whose activities require frequent reference to colors of varying hue, cast, intensity, etc. We should be pleased to know what our readers think of the possibility of effecting a better standard of color terms.*]

The Bleaching of Cotton Warps

By GEORGE NAJAR

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FROM time immemorial bleaching of cotton has been a problem. The ancient method of wetting the cotton or linen material and laying it on the grass to whiten has long ago been replaced by using chemical agents. Different kinds of cotton materials have been bleached by different or especially suited machinery, using the same bleaching agent.

The subject of bleaching is a broad one, and methods which are used in different mills are various.

The writer is going to confine himself only to cotton warp bleaching. The chemical bleaching agent used is chloride of lime, so called, although there are other good bleaching agents in the market. So far no other agent has replaced chloride of lime, because of its low cost and its sure result.

Furthermore, the mechanical end of the process will be mostly dwelt upon here, the chemical actions being too well known and fully dealt with in various bleaching and dyeing trade journals.

There are two methods used for bleaching cotton warps—a quick half-bleach machine method, and tank bleach method, which is longer.

A few words as to how warps came to be bleached may be necessary for the full discussion of the process. A warp may consist of a different number of chains, varying from 300 to 950 ends, the length also varying from 3,000 to 10,000 yards. For convenience of handling, the chain is doubled to about 1,000 yards and is wound by binding string while doubling. As a rule, four of these chains make a set, and as a set they go through the machines during the various runs. As a preparatory step the chains are boiled out by running them through the boiling machine. The boiling machine consists of a square wooden box 3 feet wide, 3 feet deep and 5 feet long, with a frame in it, equipped with four brass rolls at the bottom and three on the top. A pair of iron core rubber-covered squeeze rolls are set on the end of the box. The chains are run through boiling water with 1 per cent caustic soda. If better penetration is required two runs might be given.

Then the chains are run through 7-8 twaddle bleaching solution. This can be done twice for more even effect. Then they are left in boxes to age, so called. The time it takes to age varies according to the quality of the cotton and the size of the yarn, better quality and finer yarn aging much quicker than poorer stock and coarser numbers, varying from one-half to one and one-half hours. Then it is washed through a washer similar to a boiling machine, with plenty of wash water coming in at the bottom of the box and on the side of the squeeze rolls and going out on top near where the chains go in. This machine can be made a double washer by doubling the boxes and having two pairs of squeeze rolls.

The chains are soured in the first part of the double washer by running them through a solution of $1\frac{1}{2}$ twaddle sulphuric acid and water, and washing them in the second compartment in the same run. Doing this in the same run eliminates quite a little of the free chlorine smell. The chains are then given another double wash to get out all the traces of acid.

As said before, this gives a half-bleach which is mostly used when a clean bottom is needed for light shade of coloring. There is danger of tendering in this method if the chains are left too long to age, and detrimental results in coloring if all traces of acid are not completely washed.

The chains are run through the boiling machine and led into a kier instead of into a box. Half or one per cent caustic soda in the boiling box will help for better wetting out. Six or seven sets, or twenty-four to twenty-eight chains, can be laid in the kier, according to the size of the kier and size of the sets of four chains. The chains can be laid very easily by passing them after leaving the boiling-out machine over a reel set on the top of the kier.

The yarn in the kier is covered with a cloth to prevent water running directly over it. The kier is then filled with water and boiled by circulation method.

A centrifugal iron pump is so placed near the kier that liquor from the bottom of the kier will flow into the pump, which passes the liquor through a heater and discharges it on the top of the yarn. In this way no direct steam comes in contact with the yarn and a complete circulation is produced.

A small dissolving box is put conveniently near the pump so that 2 per cent caustic and 1 per cent soda ash can be dissolved and run into the liquor flowing into the pump, so that it mixes gradually with the main body of the liquor without damaging the yarn, as would be the case if it was dumped all together on top of the yarn. Eight to ten hours of boiling gives a good result for ordinary bleached goods. A thermometer inserted on the pipe between the pump and heater, or anywhere on the body of the kier, will give the necessary information for the regulation of steam for the heater.

After the kier comes to a boil and the necessary chemicals have been added and steam-checked, leaving enough to keep it boiling, the boiling process can be done very conveniently at night, provision being made to keep the pump running.

After eight to ten hours' boiling the liquor is drawn by a valve set between the bottom of the kier and the pump. The yarn is passed over the reel and run through the former boiling box; but instead of hot water being used in the machine a large quantity of wash water is run through, so that the boiling machine is converted into a washing machine, the yarn being washed, squeezed and laid, set by set, in boxes ready to be put into the bleaching tank.

The bleaching tank and its equipment consists of a cylindrical tank 6 x 6 feet. This can be wood, but

concrete is preferable. The tank is connected at the bottom with two concrete pits and a centrifugal pump. The main pipe coming out of the bleaching tank at the bottom branches out one to each pit, and one nearest the tank connects with the pump. One of the pits is filled with 2 per cent twaddle bleaching solution, the other with $1\frac{1}{2}$ per cent twaddle sulphuric acid solution. The pipes leading into the pits are equipped with valves. Another valve is put just as close to the bleaching tank on the main pipe as is possible and a discharge valve. Another concrete tank is used for dissolving and setting chloride of lime, which is placed preferably in an adjoining room and connected with bleaching liquor pit to replenish the stock solution.

The yarn or sets are laid into the tank over a power-driven reel and covered with cloth. Then the bleaching stock solution is pumped over the yarn, the bottom valve of the tank being closed. When sufficient liquor is pumped to cover the yarn, the valve leading to the bleaching pit is closed and the valve at the bottom of the tank is opened; the acid valve and discharge valve, of course, being closed, the liquor flows into the pump again. The bleaching solution percolates through the yarn constantly, to be discharged again on the top. Thus a complete circulation is produced. The bleaching solution can be heated in winter months by connecting a small steam pipe to the pipe leading to the pump.

According to the kind of cotton or size of the yarn this circulation is kept up, varying from one to three hours. The yarn should be watched as the bleaching is progressing. When it looks satisfactory, the liquor is drawn by gravity into the bleach pit and the valve closed. Then the wash-water valve is opened and the tank filled with water and circulated a few minutes and drawn off through the discharge valve into the sewer.

Then the pump is primed and the acid valve is opened and the acid solution is pumped on the yarn. After a few minutes' circulation it is run back into the acid pit.

Two thorough washes are given after the acid treatment, and the yarn is left to drain ten to fifteen minutes and is then ready to be taken out.

The reel being equipped with double belting, the yarn can be reeled out of the tank into boxes and given one or two more washes through the double-washing machine to be sure that all traces of acid are washed out and the yarn squeezed dry. Then the yarn is ready to be colored, or to be soaped and blued in the regular machines.

It is necessary that all the valves, fittings and the pump should be Monel metal, Duriron or some acid-resisting metal. Of course, after every bleaching the stock solution of bleaching liquor and acid solution are brought to standard before they are used again.

If it is possible it is better to line the acid pit with sheet lead, acid attacking the concrete more or less; but it is necessary that the pipe leading into the acid tank should be lead-lined or all lead.

(Concluded on page 25.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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[*Publisher's Note: Professor Olney has been quite ill for the past three weeks, hence was able to take little part in the preparation of this month's Technical Supplement of The REPORTER. Particularly, he was unable to complete the second instalment of his paper on "Operations Preliminary to Dyeing Wool Fiber." We are glad to report, however, that his health is improving, and we believe that he will be with us again in March.*]

THRIFT—FOR OTHERS

THE task of co-ordinating the amazing number of interrelated industries and enterprises involved in a well-rounded, self-contained coal-tar chemical industry in its stupendous entirety, from the mining and coking of coal down to the production of the rarest and most highly complex coal-tar products for special purposes, as well as the marketing of other by-products—the task of creating new outlets for new products so that the whole industry may be carried forward upon sound economic principles, and of finally gearing up the entire machinery and getting it running so that all parts work smoothly, is so exceedingly intricate and fraught with so many inevitable and disheartening setbacks that one sometimes must marvel that it was ever accomplished at all, anywhere, by anybody. Such accomplishments do not “just happen.” They require careful planning and considerable foresight plus infinite patience and a painstaking attention to detail. The world has had but one approximately perfect example of the flowering of the coal-tar chemical industry, and this has been provided by Germany. It is the task of emulating her example which America, England, France and all the civilized powers now face if they are to meet the strain of modern industrial and military competition.

In Germany nobody wasted any time saying that such a thing had not been done before, and that to

plan ahead in that manner was un-German. Results were what counted and the German Government frankly let it be known that results were what it was after, and proceeded to shape all things toward the attainment of those results. It went openly to work, creating a subsidy here and issuing intelligent instructions there—instructions which had all the force of an imperial mandate—and nobody thought it strange. The German Government knew what it was about and the people knew that it knew. They foresaw the future and recognized the fact that self-preservation is the very first law of nature, to which all other laws in turn give way, and they saw no more indelicacy and no more need of the Government apologizing to themselves or others for going openly to work to direct the people into the proper channels than we would for encouraging large families.

Yet the minute somebody suggests that all hands must work together in this country to foster our coal-tar chemical industry, somebody else—some officious and inconsequential jackass usually—shrieks in horror that it is un-American to even have thoughts of that nature. The country's industries must be allowed to develop naturally—which, by the way, is the manner in which weeds develop—otherwise the inviolable principles of this great democracy will be shattered to pieces. They must be allowed each to go its own gait in a delightfully vague and haphazard hodge-podge of duplication and wasted time until each settles to its proper level, or else, you are warned, America will be in the grip of huge trusts, stifling healthy competition, riding on the backs of the little people and generally ruling this free land.

As George Otis Smith, Director of the United States Geological Survey, told members of the American Iron and Steel Institute, the use of coal in America for making coke dates back eighty-odd years, but the operation of by-product coke ovens covers only one-third of that period, and it was as late as 1919 before the output of by-product coke, for the first time, equaled the output of the beehive ovens. The amount of money wasted in this way seems like a hazy, impersonal thing when stated in statistical reports, yet as a matter of fact it came directly out of the pockets of each and every one of the citizens of this country—out of your pocket and ours in proportion to our respective incomes. To prove this would involve a lengthy dissertation upon the laws of economics, but it is true none the less because we do not here attempt it. Try to realize what it means to you, and what it would have meant if the United States Government had been as far-seeing and as frankly, bluntly outspoken in behalf of America as the German Government was in behalf of Germany.

The Government is to-day, and has been for some time past, shouting for thrift, thrift, thrift! among citizens as a means of quickly paying our war debt. Yet by stupidly refusing to exercise ordinary horse sense in place of frayed and wornout traditions in the

matter of the coal problem alone, it is proving itself quite as much of a waster as the most reckless of those who participated in the after-the-war orgy of spending. Letting bygones be bygones and considering only the present, we must remember that the situation was very forcefully called to the attention of our legislators a year and three-quarters ago—and nothing has been accomplished yet. The whole of 1920 was allowed to pass without getting the Dye bill out of the Senate; the measure was in that body's keeping on New Year's day over a year ago, and was still there on New Year's day a month ago, and to-day—well, it is *still* there. The checking of the annual waste of the by-products of coal in this country could have proceeded at a far swifter pace had those to whose enterprise we shall eventually owe economic independence in this respect only been enabled to feel sure of their ground, even for a limited time. But the Government merely encourages the observance of Thrift Week in memory of Benjamin Franklin, which means, apparently, Thrift Week for someone else besides the Government.

The coking industry is about evenly divided now between the old and the new practice, but two advantages of the by-product ovens over the beehive ovens alone show how much the full substitution will mean when complete. First, the yield of coke in the by-product ovens compared with that of the beehive ovens is 23 to 25 per cent greater with the low-volatile coals, and 7 to 8 per cent greater even with the high-volatile Pittsburgh coal; and second, the recovery of 7 to 15 gallons of tar, benzol, toluol, etc.; 16 to 30 pounds of sulphate of ammonia, together with the surplus gas—well, that, of course, is the main feature so far as our readers are concerned. And Mr. Smith points out that the recent consolidation of "five great chemical companies calls attention afresh to the value of these wasted constituents of coal, for not only will this consolidation go far in making America industrially independent in the matter of dyes and other coal-tar derivatives, but the new corporation is founded chiefly on the profitable utilization of coal smoke."

By its very name the by-product practice suggests not only saving rather than waste, which is interesting to all, but it also suggests the lower cost of the chief product thereby made possible, which is particularly interesting to steel men. The experience of the leading producer of metallurgical by-product coke affords conclusive evidence that in the Pittsburgh district this coke can be furnished to the furnace at so much lower cost than the beehive coke as to give an ample return on the large investment required. Mr. Smith brought out an important but less talked of aspect of the case when he said: "It is very profitable to save the by-products, yet the fact must be faced that the beehive ovens have been within the reach of operators who had relatively little capital, whereas a modern by-product plant on an efficient scale involves an investment of many millions. Conservation of the full value of coal is not a poor man's proposition."

Big capital, plus intelligent and far-seeing direction, is the only answer to this problem affecting us vitally in so many different ways which are apparently so remote from the dye and textile industries that they can have no connection with them, and big capital will remain shy just so long as the Government withholds assurance of reasonable protection. What Charles P. Steinmetz had to say recently about the waste of coal in this country ought to awaken many, but it probably will not do so because most people are so used to hearing that sort of reminder that it has well-nigh lost its meaning. Yet with only 200 years' supply remaining—and this is a very short time in the life of a nation—we are already faced with the adoption of more efficient methods of extracting the multitudinous forces and products of coal lest that supply give out before we get our solar engines, or whatever the next source of light and power is to be, perfected and in working order.

More immediately, affecting the present generation if we do not soon begin to get the maximum of good out of our coal supply—that is, the maximum as set by present human standards—we shall fall behind the world in many ways besides the relatively unimportant matter of color for our garments. It is a vital economic problem which the country faces in this matter, and it would no doubt surprise a large number of the general public to learn that the Dye bill is one of the most important national thrift measures ever framed.

While the Government continues to call for thrift, let it not provide the spectacle of a waster preaching economy. Nothing, no matter how radical or novel it may *sound*, is "un-American" which seeks to realize, for Americans, on America's natural resources in a legitimate way. Nothing could be more un-American than this continued deliberate neglect of such a glaring waste.

PURSUING THE CANCELLED ORDER EVIL

EMULATING the silk people in their desire to get rid of the cancellation evil and provide against another such chaotic condition as recently prevailed in the trade, the knit goods jobbers and manufacturers have likewise taken steps in self-defense by the preparation of a uniform contract blank which will be used in future by all members of the various organizations endorsing it.

The knit goods interests, however, have varied the program, although the object is the same as that of the silk men. The knit goods contract, which is worth examination as the latest effort to straighten out such matters, takes cognizance of the fact that a manufacturer who sells more than he can deliver and therefore becomes either unduly late in his deliveries or careless about meeting specifications, is as much at fault and responsible for resulting evils as the buyer who seeks to avoid his just obligations.

The new proposed contract carries a penalty for de-

lay in delivery, and, like the silk contract, provides for the creation of an arbitration board with authority to settle differences which may arise in connection with the provisions of the contract. It is generally recognized that a fair proportion of the over-ordering which became so common during the recent "boom" was the direct result of deliberate duplication of orders on the part of those who wished to be certain that they would get goods from someone—and did not much care from whom. The proposed penalty should have a healthful effect by causing the manufacturers to think twice before "selling" more goods than they can possibly turn out within a given time, and by reducing materially the number of purchasers with the "sagacity" to order in duplicate or triplicate from two or more manufacturers in a sellers' market such as prevailed.

Both organizations seem to have effectually gotten at the root of the evil by different methods, but the underlying truth governing both situations as brought out at the silk meeting remains the same, namely, that unless both sides to the controversy are willing to observe the ordinary principles of business honor, and to display a reasonable tendency to meet each other half-way, no amount of regulation, nor specially devised contract forms, can stamp out this exceedingly harmful practice. It is believed, however, that both sides have seen the light and are to-day willing to get together to rejuvenate business. Reports are now coming in from all sides of renewed activity in the mills, and while the climb back to normal conditions is certain to take time, all signs would now indicate that it has begun.

STRENGTHENING THE BRITISH LICENSE LAW

WITH the arrival in this country of copies of the British Dyestuffs Import Regulation Act as finally amended and passed by the House of Lords late in December, it may be seen that the measure in question was clarified and strengthened, and in no way rendered less efficient. The final draft stands, as before, a highly praiseworthy example of far-sightedness expressed through clean-cut, practical legislation, and its treatment by Parliament should shame the Senate into action on our own measure even if no sense of American necessity will. Five paragraphs, all told, were added to the British law, which sounds like rather a great deal, in view of its original brevity, until they are looked into. Otherwise, no changes were made in the wording as given in full in *THE REPORTER* at the time of its passage by Commons.

The first addition occurs in Section 2, the inserted paragraph, (2), reading:

"A license granted under this section shall not be transferable."

It is Section 2 which gives the British Board of Trade the authority to license the importation of products prohibited by the Act, and the new paragraph needs no further comment.

In Section 3, which provides for the appointment of a Licensing Committee consisting of five color users, three manufacturers and three persons concerned with neither of these interests, Paragraphs (4), (5) and (6) have been added. Paragraph (4) reads:

"If on an application for a license under this Section the Committee are satisfied that the goods to which the application relates are goods wholly produced or manufactured in some part of His Majesty's dominions, a license shall be granted in accordance with the application."

This serves to emphasize again that England is going to look after England, just as any nation should look after its own, and that she and her possessions will act as a unit to make themselves independent of all foreign sources of supply as well as to insure their keeping abreast of the rest of the world in the matter of preparedness. It should bring the fact home to the Senate, too, that our next-door neighbor, Canada, can make and sell in England any coal-tar products which she can produce and find a market for, whereas we can only sell such products as the British cannot yet make, which, under such an efficient system, will grow steadily fewer, while our own production, unless it gets the same system, will dwindle to nothing under the German onslaught.

Paragraph (5) of Section 3 reads:

"An applicant for a license shall be entitled to object to any member or members of such committee dealing with his application on the ground that he is prejudiced, owing to the fact that such member or members is or are trade competitors, and, if such objection is sustained by the committee, the member or members so objected to shall withdraw from further consideration of the case, and shall not have access to any information or documents concerning it."

This paragraph should go far toward eliminating once and for all the frequently voiced objection that dye users would, under the licensing system, be obliged to submit their trade plans and secrets to rivals in order to obtain needed colors from foreign sources, and it provides practically perfect protection against such a contingency, since the five color users on the committee, in case all were determined to act together, could still be out-voted by the three color manufacturers and the three "neutrals." Such a clause in the Dye bill, however, is entirely unnecessary, since the administration of the proposed American law would be in the hands of the Tariff Commission, consisting entirely of "neutrals" having no personal interest whatever in the doings of any individual textile manufacturer.

Paragraph (6) in the same Section reads:

"For the purpose of advising them with respect to the efficient and economical development of the dye-making industry, the Board shall constitute a committee of persons concerned in the trades of dye-maker or dye-user and of such other persons not directly concerned in such trades as the Board may determine."

This, too, is an excellent idea; not content with merely providing a committee for the issuing of licenses, the British now go a step further and add another committee to act as a personal sort of shepherd over the dye industry, possibly to help insure sufficient progress before the ten years provided for protection are up. As we have emphasized elsewhere, the coal-tar chemical industries are of a sort which demand some kind of a central supervising body in order to obtain the maximum of efficiency. In Germany it was the German Government which acted in this capacity, with authority to do what it liked. In England it is to be a committee with no actual power except to advise the Board of Trade, which presumably can wield sufficient influence to act as an effectual guide. In the United States there would be no official or even semi-official body, but the Tariff Commission has in the past adequately filled all needs in this respect and doubtless would continue to do so in its new role, if it would continue to be an advisory body to Congress.

Paragraph (3) of Section 5 we have already made the acquaintance of. It simply states that:

"This Act shall come into operation on the fifteenth day of January, nineteen hundred and twenty-one."

Thus it may be seen that England's problem of future preparedness is settled, as well as the lesser problem of ever again facing the complete demoralization of her important textile and other industries in the event of anything interfering with foreign supplies. In the face of so rapid and entirely reasonable an elimination of what is in reality so simple and clearly defined a difficulty—the very same difficulty that faces the American dye industry and all its ramifications to-day—it is indeed difficult to understand how the Senate as a body can display such utter stupidity and wilfulness as to allow this uncertainty to continue. It is difficult to understand how a presumably capable body of men, used to the ways of the world and all sorts of "political skullduggery," can allow themselves to be held up and prevented from passing a measure, which a known majority favor, merely by a thinly disguised German lobby claiming to represent the textile interests of America.

In the strong editorial in the *Manufacturers Record*, "Has America No Answer for This German Threat?" published in The REPORTER of January 24, there occurs the sentence: "It is difficult to speak with moderation of those Senators who have resorted to the filibuster and every other technical device of legislators to delay and prevent enactment of the Dye bill."

Difficult? Gentlemen, it is impossible! There was a time when one could—when one felt one ought to. But any idea of speaking with moderation about such tactics as the country has been given an exhibition of by the Senate vanished months ago, when the Senate had been juggling the bill only a little over a year. Facts are facts; a spade is a spade, and referring to it as a garden implement will not beautify it.

The indifference of the Senate toward this vital measure, thereby putting the military and industrial welfare of the country in jeopardy, will be remembered long after the present body has passed out of existence, and its childish babbling and indecision, its meek submission to the determined effort of an organized minority where real men would have stood their ground and fought until they won recognition of the rights of the majority—and without making too much stir about it, either—can never, while memory of it remains, be thought of as other than an outlandish travesty upon the sort of government the framers of the Constitution hoped to create.

It is to be hoped that some one of the numerous supporters of the Dye bill will have the hardihood to get up and force the issue before this session ends.

The Dyeing of Artificial Silk

By the Late LEONARD PHILIP WILSON and MARJORIE IMISON

THE dyeing of artificial silk has, as a rule, been considered to be practically identical with the dyeing of cotton, but since it has a greater affinity for dyestuffs, and unevenness in shade is occasionally observed in the dyed material, it was thought desirable to investigate the dyeing of viscose artificial silk from a fresh standpoint.

It has hitherto been assumed that all direct cotton colors are as suitable for use with artificial silk as with cotton, but recent research has clearly shown that only a limited number can be considered to be eminently suitable from the point of view of giving even effects. The reason for this is that many of these colors are extremely sensitive to those small differences of dyeing affinity which are at present liable to occur occasionally in artificial silk, as indeed they do in all textile fibers, but which in the case of short fibers, such as cotton and wool, are concealed by the mixing of a very large number of fibers to form a thread.

Among the sulphur colors also there are many which are very sensitive to variations in the affinity for dyes of the artificial silk fibers, but fortunately the "even" or less sensitive colors of this class include shades which help to fill in the gaps in the range of "even" direct cotton colors. By the term "even" as applied to dyestuffs in this connection is meant the property of the dyestuff of giving an equal depth of color on artificial silk fibers of different affinities.

Tannic acid, which is used as a mordant for basic dyestuffs, is taken up by the thread like a dyestuff and behaves to a certain extent in the objectionable manner of many of the direct cotton and sulphur colors; thus, if there are irregularities in the artificial silk, the basic colors when used with a tannic acid mordant may give uneven results. Where they are used for topping other dyestuffs, the final result is dependent upon the effect obtained with the bottom color.

Sky Blue FF is one of the dyes which is frequently connected with complaints of uneven dyeing, but recent research has shown that if there are some conspicuous offenders in this respect, there are others—e. g., Chrysophenine G, of which no complaint can reasonably be made, since they consistently give even shades when used in the orthodox manner.

Methods have been devised which serve to measure the extent to which a dyestuff can exhibit unevenness. A large number of dyes have been tested and, according to the degree of evenness which they show with fibers of known different affinities, when dyed under standard conditions, have been classified as "even," "moderately even," and "uneven."

No superiority in respect of evenness can be claimed for the products of the German dye works. A given dyestuff, whether it be labeled Diamine, Oxamine, Dianol or Paramine, will be classed as "even" or "uneven" (as the case may be) according to its constitution and behavior, which are independent of its German or British prefix. For example, Diamine Sky Blue FF (Cassella), Chlorazol Sky Blue FF (Brit. Dyestuffs Corp.), and Chloramine Sky Blue FF (Sandoz) are all "uneven," as are also Diamine Black BH (Cassella), Oxamine Black BH (Badische), Melantherine BH (Soc. Chem. Ind., Basle), Melantherine BH (Clayton Aniline), and Chloramine Black BH (Sandoz). On the other hand, Sultan Yellow G (Brit. Dyestuffs Corp.) and Chrysophenine G (various makers) are "even," while Cotton Red 4B (Soc. Chem. Ind., Basle), Benzopurpurin 4B (Sandoz), Benzopurpurin 4B (Brit. Dyestuffs Corp.), and Diamine Red 4B (Cassella) are "moderately even."

It has been found, however, that evenness (at normal dyeing temperature, 50 deg. Cent.) varies according to the molecular weight of the dyestuff used; the arrangement of the groups in the molecule and their nature have, apparently, no real effect. The dyestuffs of low molecular weight give very even results under normal dyeing conditions, although the silks may vary considerably; while with the same irregular silks the dyestuffs of high molecular weight give uneven results. For example, Rosophenine 10B (mol. wt. 600) is even dyeing, whereas Dianol Sky Blue (mol. wt. 992) is very uneven; Indoine Blue (mol. wt. approx. 521) is very even, but Dianol Fast Pink BK (mol. wt. 944) again is very uneven; Diamine Green B (mol. wt. 812) is fairly uneven, and so on. The result is that fabric made up of artificial silk of varying affinities will show variations in shade when dyed with dyestuffs of high molecular weight and a practically even effect if dyestuffs of low molecular weight are employed.

The lists given below show the direct cotton colors which have been tested classified as those showing good evenness, those of moderate evenness and the uneven ones, determinations having been made by dyeing at 50 deg. Cent. The lists may include the same dyestuff under more than one name, and must, for the present, be regarded as provisional and subject to alteration as research proceeds. A large number of German dyes which have been tested are not included.

EVEN DYES (DIRECT COTTON COLORS)

Red.—Chlorazol Red A, Chlorazol Pink RD, Chlorazol Fast Bordeaux B, Dianol Fast Red K, Dianol Fast Red FG, Congo Corinth GW, Congo Rubine (all British Dyestuffs Corporation), Chloramine Red B, Chloramine Fast Red F (Sandoz), Rosophenine 10B (Clayton Aniline), Rosanthrene B, Rosanthrene R, Rosanthrene Bordeaux B, Cotton Red C (Soc. Chem. Ind., Basle).

Brown.—Chlorazol Brown GR and Dianol Brown GM (Brit. Dyestuffs Corp.), Trisulphon Brown MB and Chloramine Brown 2R (Sandoz), Cupranil Brown B and Chlorantine Pure Brown 3GL (S. C. I., Basle).

Orange.—Congo Orange R (Brit. Dyestuffs Corp.), Paramine Direct Orange R (Holliday).

Yellow.—Chrysophenine G (Sandoz), Sultan Yellow G (Brit. Dyestuffs Corp.), Cotton Yellow CH (S. C. I., Basle).

Blue.—Indoine Blue (Badische; this color dyes artificial silk without a mordant).

Violet.—Chlorazol Violet WB (Brit. Dyestuffs Corp.), Direct Violet 2B (S. C. I., Basle).

MODERATELY EVEN DYES

Red.—Brilliant Congo Red R (Sandoz).

Brown.—Paramine Direct Brown G (Holliday), Dianol Brown 2494 (Brit. Dyestuffs Corp.).

Orange.—Stilbene Orange 4R (Clayton Aniline).

Yellow.—Titan Yellow G (Brit. Dyestuffs Corp.).

Green.—Dianol Dark Green N (Brit. Dyestuffs Corp.).

Violet.—Direct Violet 2R (S. C. I., Basle).

Black.—Vulcan Black 2GW (Brit. Dyestuffs Corp.), Direct Fast Black B (S. C. I., Basle).

UNEVEN DYES (DIRECT COTTON COLORS)

Red.—Direct Fast Scarlet SE (S. C. I., Basle), Chloramine Brill. Red 8B (Sandoz), Dianol Fast Pink BK (Brit. Dyestuffs Corp.).

Brown.—Trisulphon Brown B and Trisulphon Bronze B (Sandoz), Cupranil Brown G (S. C. I., Basle).

Orange.—Pyrazole Orange G (Sandoz).

Yellow.—Dianol Fast Yellow ARX and Afghan Yellow GX (Brit. Dyestuffs Corp.), Paramine Direct Yellow R (Holliday), Oxyphenine R and Oxyphenine GG (Clayton Aniline).

Green.—Dianol Green BG (Brit. Dyestuffs Corp.), Direct Green G and Direct Green B (Sandoz), Direct Green B (Clayton Aniline).

Blue.—Sky Blue FF, Dark Blue B, Blue 2B, Fast Blue G (all makers), and many others.

Violet.—Trisulphon Violet B (Sandoz), Direct Violet R (Clayton Aniline), Chlorazol Violet BN, Dianol Violet R 9068 K, and Dianol Violet R (Brit. Dyestuffs Corp.), Direct Violet N (S. C. I., Basle).

Black.—Black BH (all makers), Chlorazol Black E Extra and Dianol Black No. 1 (Brit. Dyestuffs Corp.), Chloramine Black HW and Chloramine Black EX Extra (Sandoz), Melantherine TH and Indigene Black BW (S. C. I., Basle).

From these lists it is apparent that there are many

direct cotton dyestuffs which, when employed in the usual manner, will give satisfactory results if there is any unevenness in the artificial silk; but, on the other hand, a considerable number will give good and even shades in most colors. The work of investigation into the evenness of dyestuffs is still in progress, but up to the present only one or two satisfactory direct blues have been found, and for most blue shades other methods must be adopted to insure more even results. It may, however, be possible, now that the test of evenness has been ascertained, for manufacturers to produce blue dyestuffs of low molecular weight, and investigations have been started with this end in view.

It has been found, moreover, that it is possible by dyeing at other temperatures to obtain more even results with dyestuffs which, when tested at 50 deg. Cent., were classified as uneven. With higher temperatures of the dye bath, the amounts of dye absorbed by two silks of very different affinities gradually approach one another, so that whereas when dyed at 35 deg. Cent. one silk might be six times as dark as the other, when dyed at 75 deg. Cent. there is very little difference between them; the silks, of course, were immersed in the bath at the proper temperature, and not put into a cool bath and subsequently heated.

When using mixtures of direct cotton dyestuffs, even results can only be obtained if all the dyestuffs in the mixture are even; a dye bath composed of both even and uneven dyes almost invariably gives worse results than the uneven dyes alone. It has also been found that when material dyed with an uneven dye and showing variation in shade is bleached and afterwards redyed with an even dye, the final result will frequently be uneven.

It has already been stated that some of the sulphur colors will help to supply the deficiencies in the direct colors. The sulphur dyes as a class cannot, however, be said to give even results, as many of them do not; but it is fortunate that among the blue sulphur colors some have been found which give even shades on artificial silk of varying affinity. It is possible, therefore, by the use of these to extend considerably the range of colors which do not show unevenness, and the following dyestuffs can be recommended to this end.

EVEN DYESTUFFS (SULPHUR COLORS)

Thionol Sky Blue PX (Brit. Dyestuffs Corp.), Pyrogene Direct Blue RL, Pyrogene Direct Blue (green shade), and Pyrogene Indigo (S. C. I., Basle), Thionone Brilliant Blue G and Thionone Navy Blue B (Holliday).

The sulphur colors named below have been found to give uneven results:

Blue.—Thionol Navy Blue R., Thionol Navy Blue 9055 K, Thionol Direct Blue S (Brit. Dyestuffs Corp.), Thionol Dark Blue S and Thionol Dark Blue RL (Sandoz), Thionone Indigo R and Thionone Navy Blue 2R (Holliday).

Black.—Thionol Black OG, Thionol Black XXN

Conc. and Thionol Black SGG (Brit. Dyestuffs Corp.), Thionone Black Paste (Holliday).

Green.—Thionol Green DY (Brit. Dyestuffs Corp.), Pyrogene Green 3G (S. C. I., Basle), Thionol Brill. Green 2G (Sandoz).

Brown.—Thionol Brown O (Brit. Dyestuffs Corp.).

The basic colors find considerable application on artificial silk where great fastness in the dyed silk is not essential. In addition to producing extremely bright shades, basic dyes as a class possess the great advantage of giving the most even dyeing results. In fact, almost without exception these colors can be made to give shades which show no sign of unevenness when used to dye artificial silks of very different affinities. It should be noted that these dyes are of low molecular weight.

With the usual method of dyeing—i. e., with a preliminary mordanting with tannic acid and tartar emetic—unevenness may, as stated above, sometimes result when the material is dyed, but to a much smaller extent than with many of the direct colors. The most even results are to be obtained by dyeing first in a neutral dye bath and then fixing in tannic acid and tartar emetic.

The fact that basic colors are, on the whole, even dyeing enhances their value for topping direct or sulphur colors and extends the range of shades which can be produced, and which might be curtailed by the reduction in the number of dyes available if only those which fulfill the requirements of even dyeing are to be used.

It has thus been found that among all classes of dyestuffs investigated there are some which under normal conditions of dyeing exhibit great sensitiveness to variations in artificial silk, and special methods have been indicated for dyeing with some of these colors which tend to make them less sensitive. On the other hand, there are many dyes of undoubted even-dyeing properties covering, in one class or another, a full range of colors; and it is hoped that the extended use of these and the restricted or more careful use of uneven colors will tend further to eliminate irregularities in dyed viscose silk.

—*Journal of the Society of Chemical Industry.*

THE BLEACHING OF COTTON WARPS

(Concluded from page 19.)

The bleached yarn has kept its original strength. In fact, experiments right in the mill show that the breaking point is higher than that of gray yarn which has not been wet out. Of course, the explanation is that cotton yarn wet out is stronger than gray yarn not wet out, and bleaching the yarn in this way not only does not weaken but rather makes it stronger than gray yarn which has not been wet out.

The yarn, not being handled so much and not being run through the machine so many times, is in a better condition for beaming or quilling. After installation the bleaching cost is less than the first method. Different parts of the chain having been treated simultaneously, the liquor having been pumped on all parts at once and run off all at once, the chains are bleached uniformly.

The Estimation of Mechanical Wood Pulp

By M. G. KOTIBHASKER, M.Sc.Tech.

FROM time to time various methods have been proposed for the quantitative determination of mechanical wood in mixed pulps and papers. They may be classified under three heads—microscopical, calorimetric, and chemical.

1. *Microscopical*.—The microscopic method of Vetilart (*Etudes sur les Fibres Vegetables Textiles*, Paris, 1876) is in general use. It is based on the color reactions of chlorozinciodine and aniline sulphate on mechanical wood pulp. This method calls for considerable care and experience, and owing to the small and variable size of the particles of mechanical wood it becomes very difficult to make an accurate estimation of the proportions by weight and to prepare slides representing average samples of the paper.

2. *Colorimetric*.—C. F. Cross (*J. Chem. Soc.*, 1901, 1898) suggested a colorimetric method based on the action of phloroglucinol on mechanical wood. The standard sheets and the samples to be analyzed are steeped in a solution of phloroglucinol in hydrochloric acid and the intensity of the color produced compared. This method is fairly accurate for percentages below 20 of mechanical wood in the sample, but with higher percentages becomes less and less accurate, as the small differences in the color obtained are difficult to detect.

3. *Chemical Methods*.—As an attempt to get better accuracy and to minimize the subjective element, chemical methods have been devised. One of the oldest of these is that proposed by—

(a) Goddeffroy and Coulon, which depends upon the fact that lignified fibers reduce gold from a solution of gold chloride, while the purer forms of cellulose represented by cotton, chemical wood, straw and similar fibers have not this power. The weight of the gold reduced is determined gravimetrically and compared with the quantity of gold which 100 parts of ground wood will reduce.

(b) Cross, Bevan and Briggs (*Chem. Ztg.*, 1907, 725) have suggested a chemical titration method based on phloroglucinol reaction for the estimation of mechanical wood pulp, in paper, free from other lignified fibers. Phloroglucinol solution in hydrochloric acid is standardized by means of a standard formaldehyde solution. The formaldehyde solution is added from a burette 2 c.c. at a time to 10 c.c. of phloroglucinol solution in hydrochloric acid, and the mixture warmed on a water bath to 70 deg. Cent. for two minutes. The presence of free phloroglucinol in the mixture gives a red ring on the margin of newspaper.

The sample of paper under examination is cut into small pieces and opened up, and a weighed quantity steeped in standard phloroglucinol solution and kept corked overnight at the ordinary temperature. The residual phloroglucinol is estimated by titration with formaldehyde solution, and thus by difference the quantity

absorbed is determined. The end reaction in this case is not quite sharp, and this may introduce a slight error in the results obtained.

Reactions of the bases of the aryl group with the lignocelluloses have been known for some time. Aniline and its homologues give characteristic color reactions with lignocelluloses. In 1907 Wheeler (*Ber.*, 1907, 1888) suggested the qualitative use of *p*-nitraniline hydrochloride as a reagent in place of phloroglucinol.

Professor Knecht suggested to me the use of this reagent for the quantitative estimation of mechanical wood, as exact methods for estimating *p*-nitraniline are available.

A known quantity of pure mechanical wood pulp was immersed in a known volume of standard *p*-nitraniline solution, and after the absorption was complete the residual *p*-nitraniline was estimated by means of titanous chloride. The strength and the quantity of *p*-nitraniline used were adjusted by trial, so as to insure maximum absorption.

The experiments showed that the absorption of *p*-nitraniline by mechanical wood was a constant, under defined conditions. Air-dry mechanical wood pulp absorbs under such conditions 0.56 to 0.57 per cent of *p*-nitraniline. On this basis several papers of known composition were examined, and results were obtained correct within 2 per cent error. Calculations were made on the basis of 1.5 per cent allowance in the case of sized papers and 10 per cent for the moisture. Another arylamine picramic acid was similarly tried, and it was found that under the same conditions the absorption figure was in exact molecular proportion to that in the case of *p*-nitraniline, about 0.82 per cent of picramic acid being absorbed.

It is somewhat remarkable that the ratio between the absorption numbers of jute and mechanical wood is the same, in the case of both phloroglucinol and *p*-nitraniline, which confirms the fact that the combination of *p*-nitraniline with lignocellulose is a quantitative reaction of the same order as that with phloroglucinol.

	Absorption Percentage	
	Phloroglucinol	<i>p</i> -Nitraniline
Mechanical wood pulp....	6.63-6.71	0.57
Jute	4.2 -4.34	0.35-0.37

Absorption of *p*-nitraniline by various pure forms of cellulose, such as cotton wool, Swedish filter paper and chemical wood pulp, gave figures between 0.02 and 0.04 per cent.

The calculations of mechanical wood in different samples can be done by the following formula:

$$\text{Per cent of mechanical wood pulp} = \frac{\text{Per cent abs. of the bone dry sample} - 0.04}{0.60, \text{ i. e., } (0.64 - 0.04)}$$

—*Journal Soc. Dyers & Colourists.*

The Purity of White Cottons

By M. ED. JUSTIN-MUELLER

Translated from the French by Benedict C. Heyman, A.M., United Chemical & Color Co., New York

THE qualities that we expect of white cottons vary according to the selling value of the merchandise and the uses to which the goods may have to submit. All that we expect of cheaper goods is merely that it must look as white as a given standard at the time of selling, but for the better grades we demand that it should not only look white but that it should not turn yellow in the store. Again, for articles destined for dyeing and for printing a new problem arises. Here it is necessary that the white goods should be perfectly pure. The yarn or the cloth must be completely freed from impurities by thorough boiling. Chemicking is then used simply as a finishing operation.

The uniformity of dyeings largely depends on the above. For the grade just mentioned, i. e. goods which should not turn yellow in the store, it is equally necessary that the fiber be completely free of impurities. This applies not only to bleached cloth but to bleached yarn. Certain regions of France have had and still have a special reputation for the bleaching of cotton yarn. Some pretend that it is a question of water and others that it is the method of procedure. However, the chief considerations are (1) the purity of the white goods, and (2) the ability to determine quickly the degree of purity or in other words, the value of whiteness. Up to the present time the only means of determining the purity of whiteness has been by allowing the goods to remain in the store for some time to see if it would turn yellow or not.

Concerning bleached cloth destined for dyeing or for printing, I have on various occasions called the attention of those interested to the effects that proper bleaching has on the uniformity of dyeings. Furthermore, I have demonstrated by numerous experiments on cloth treated industrially the tenacity of the embodied starches in the warp. This tenacity is such that in many cases the starch is not completely eliminated by prolonged steeping in boiling lye done even under pressure. To determine whether a cloth is completely stripped or not, I have used the iodine chloride reaction. The reaction is very sensitive and the least trace of starch will manifest itself by a violet hue or sometimes by the slightest hint of violet color. On goods entirely free from starch the stain is amber colored, whereas if it contains much starch the stain changes from violet to deep blue.

We have here therefore a means of determining whether a piece of goods is completely stripped of starches. Of course, this is important but it does not give us any definite values as to the purity of the whiteness. Goods may be completely stripped by a proper malting process without being boiled in lye (the iodine chloride

reaction may confirm the fact) yet we could conclude from this only that the goods had been well treated. We could not express this whiteness by a number. Moreover we would not know that, apart from being free from starches, there did not yet remain in the goods impurities such as resinous, pectic and other matters.

From my studies on turgoids and turgometry I have arrived at a method of determining the purity of whiteness compared with a known type and of indicating the value of whiteness by exact figures. I will briefly recall that turgoids are certain solids which on contact with water or with aqueous liquids swell; that is to say, that under given conditions they absorb water without dissolving. Cotton fibers are the most typical examples of turgoids. The process of measuring the swelling has been called turgometry and the apparatus used, the turgometer.* A needle moving up and down and attached by one end to the sample to be examined indicates on a graduated sector the degree of the swelling in a given time. Having noticed that the speed of the swelling of cotton in a solution of caustic soda is the same as the speed of the swelling of the pure fiber, I have utilized this fact to determine the degree of whiteness.

EVALUATION OF THE REGULARITY OF THE TWISTING OF COTTON YARN

It may be interesting to know about the uniformity of the twisting of cotton yarn from the point of view of the yarn itself, from that of weaving, and also from the point of view of the dyeing. This uniformity of twisting can be expressed by numbers but the figures really would represent a determination of the regularity of the twisting rather than the evaluation of the degree of twisting.

In the dyeing of light shades on cotton yarn destined to be woven in a one-color pattern, the irregularity of the twisting manifests itself very often by an unevenness. The yarn having less twisting absorbs more color during the dyeing process; and even though the variation in color is apparently insignificant and not noticeable in the yarn, there will result an unsatisfactorily finished product after weaving. This unevenness is very well known in weavings with dyed yarns.

There has not been any efficient means to determine the regularity of the twisting and still less means for expressing this in figures. However, by turgometry we can practically determine the regularity or irregularity of the twisting of yarn. The same technique and ap-

*The turgometer is described in detail in "La Turgometric" by Dunot & Pinat, Paris, 1917.

paratus which we employed for determining the degree of whiteness is used, with the only difference that we have to repeat the experiment four times, using different samples of the same yarn. The tests cover ten minutes each. At the end of each minute we note the degree of sector run across by the indicating needle. Add the ten readings. The particular values so obtained for each sample of yarn ought to be very close if the twisting of the four tested samples is regular. If on the contrary these values vary conspicuously, we can conclude (1) that there exists an irregularity of twisting of the yarn, and (2) that this irregularity is in proportion to the variation of the values arrived at in the tests.

Examination of Meta-Toluylenediamine

By WALTER E. HADLEY

OWING to the recent introduction of American made diazotized and developed blacks of a similar character to the pre-war Developed Blacks, a brief outline of the manner of estimation of the strength of Meta-Toluylenediamine, used in developing same upon the fiber, should prove of timely interest to dyers who wish to keep an accurate control of the strength of dye-house products.

Meta-Toluylenediamine ordinarily exists in two forms: i. e. either as light brown colored crystals obtained by allowing same to recrystallize from ethyl alcohol, or in the form of hard lumps, dark brown in color, same having been obtained by distillation.

There are two commercial forms of Toluylenediamine found in the trade; the hydrochloride possessing a strength of about 63 per cent; and the base containing about 93 per cent of diamine.

In determining the purity of a sample of Toluylenediamine it is customary to examine same in regard to the following:

Melting Point.—Determined in glycerine bath using ordinary glass melting tubes. The melting point of Meta-Toluylenediamine is 99 deg. Cent.

Mineral Matter.—A sample of the Toluylenediamine should be ignited and weighed for ash which should not be greater than 2 per cent.

Soda Ash.—If Soda Ash has been used as an adulterant it will remain after ignition. An effervescence, upon the addition of Acetic Acid, shows the presence of Carbonates (Soda Ash).

The amount of Soda Ash present can be readily determined by weighing a known charge of the sample and extracting same in Soxhlet Extractor with absolute ethyl

alcohol. The Toluylenediamine is easily soluble, while the Soda Ash is insoluble, in absolute alcohol. The increased weight in the extraction flask therefore is due to Toluylenediamine, the Soda Ash remaining in the extractor.

While there are several methods for the determination of actual diamine, all of which give more or less satisfactory results, it is the purpose of this article to outline, in a clear and concise manner, one method which has been found to be reliable, and to be comparatively easy of manipulation.

The method depends upon the interaction of Diazotized-Ortho-Toluidine and Meta-Toluylenediamine, the end point of the reaction being accurately determined by means of an outside indicator.

Preparation of Ortho-Toluidine Solution.—The molecular weight of Ortho-Toluidine being 107, a tenth normal solution is prepared by accurately weighing 5.35 grams, dissolving in water and making up to nearly 500 c.c. volume in a graduated flask. Cool the contents of the flask by placing same in a water bath containing chipped ice. When thoroughly cooled, add 10 grams of Sodium Nitrite and allow to dissolve. Then add 15 c.c. Hydrochloric Acid (specific gravity 1.2).

Bring the volume of liquor to the mark with distilled water. The presence of nitrous acid may be noted either by smell or by testing with potassium-iodide-starch-paper.

Preparation of Meta-Toluylenediamine Solution.—The molecular weight of Meta-Toluylenediamine being 122, a tenth normal solution is prepared by accurately weighing 6.1 grams dissolving in water and making up to 500 c.c. volume in a graduated flask.

Determination of Strength of Meta-Toluylenediamine.—Place 100 c.c. of Meta-Toluylenediamine solution, as above prepared, in a half liter beaker, containing glass stirring rod, and add 5 grams Sodium Acetate.

Fill a 100 c.c. burette with the cold Diazotized-Ortho-Toluidine solution.

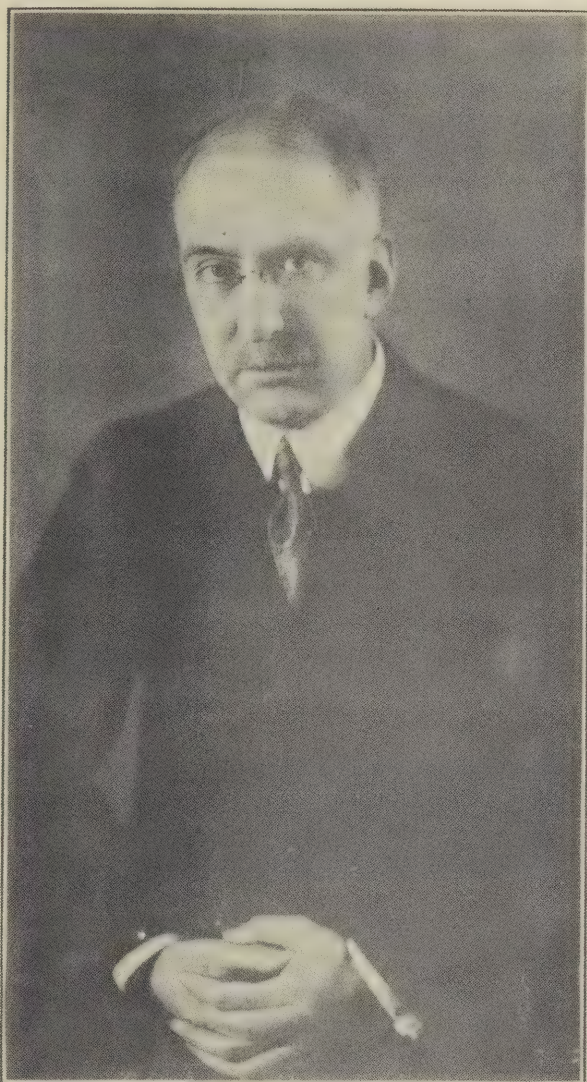
Carefully run the solution from the burette into the beaker, constantly stirring the contents of the beaker with the glass rod.

A piece of filter paper, spotted with Diazotized-Ortho-Toluidine, is used as an outside indicator, the end point of the reaction being evidenced when a red circle no longer appears on the spots upon the filter paper, when a drop of solution is taken from the beaker and placed thereon.

A solution of Ortho-Toluidine when prepared as above is of such strength that each cubic centimeter is equal to 1 per cent of Meta-Toluylenediamine, if grams per molecule liter are used.

The solution of Meta-Toluylenediamine has already been prepared in accordance with the molecular weight.

As 100 c.c. of Meta-Toluylenediamine is used for the determination, then the cubic centimeters of Diazotized Toluidine solution, read from the burette, give directly the per cent of Meta-Toluylenediamine in the sample under examination.



MEN OF MARK in the DYESTUFF FIELD

Willard H. Watkins
Manager, Buffalo Plant

**National Aniline &
Chemical Co., Inc.**

WILLARD H. WATKINS was born in Boston, Mass., in 1874, and received his preliminary education in the public schools of that city, after which he entered the Massachusetts Institute of Technology, from which he graduated with the class of 1895. Immediately upon graduation he became associated with the dyestuff industry, his first position being with the Farbenfabriken of Elberfeld Company as assistant in their dyeing laboratory. In 1896 he accepted a position as chemist and assistant dyer with the Sawyer Woolen Mills at Dover, N. H., which position he resigned in 1898 to go with the Harway Dyewood & Extract Manufacturing Company as chemist, for which concern he later became a traveling representative.

In 1900 he became chemist at the Boston branch of the Schoellkopf, Hartford & Hanna Company, where he remained until 1905, when he was transferred to their Buffalo plant as manager of the dyeing department. Subsequent to the merger of the Schoellkopf Aniline & Chemical Works with the Wm. Beckers Aniline & Chemical Works and the Benzol Products Company, to form the National Aniline & Chemical Company, Inc., he was appointed chemist in charge of the dyeing laboratories of the latter concern. In 1919 he became manager of the Buffalo plant of the National Aniline & Chemical Company, which position he still holds.

During his entire professional career, with the exception of the last year, Mr. Watkins' main interests have been connected with the application of coal-tar dyes, and he is recognized as one of the leading American authorities on subjects of this character. He has been active in the Buffalo section of the American Chemical Society, having been its chairman for two years and a member of the general council from this section since 1915. In 1919 he was appointed a member of the Advisory Committee on Dyes of the War Trade Board, in which capacity he rendered most valuable services to the dyestuff consuming and manufacturing industries.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

S. M. W. Co.—*Question*—Will you kindly inform me just how to make equal parts of Tallow, Palm and Elaine oil soap, and the amount of caustic soda and water to make a good soap to scour blankets? Also, how to deodorize it?

Answer—As the exact adjustment of alkali to the fats is a most important feature of a practical soap, it is not advisable to give a definite recipe for the soap you require, but if you follow the following directions you should be able to produce a very satisfactory soap that will answer all the requirements. First obtain true samples of the fats and oils, also of the caustic soda you intend using. Melt together about a pound sample of the oils in the exact proportion you intend using them. Send this sample of mixed fat and a sample of the soda to an analytical chemist and have him report to you how much of that particular grade of soda will exactly saponify 100 pounds of the mixed fat. Having obtained this figure, melt the oils together at the lowest temperature that will keep them liquid. Dissolve the caustic soda in the same weight of water as you have of oils. Stir the caustic solution into the oils without boiling or further heating. Continue stirring until perfect uniformity results (a mechanical stirrer is much better than hand stirring). Then run the mass into barrels or boxes and allow them to stand undisturbed for a week. This results in what is called cold saponification and differs from a boiled soap only in that it still retains the glycerine, which is no detriment. The proportions must be correct, as an excess of alkali is harsh on the goods and an excess of oil lowers the scouring power and may make the wool greasy. This method of procedure applies to all oils, but generally fails to give good results because it is carried out by using a set formula from a book instead of having the exact figures furnished by a chemical analysis, as they would do in a practical soap works.

W. E. T. Co.—*Question*—We have read with great interest the article by Louis A. Olney in your issue of January 3. This has a direct bearing on a problem which, at present, confronts us. Some time ago we purchased a quantity of worsted yarn from an outside spinner and

have found considerable difficulty in getting an even dye on this yarn. Our dyer claims that the yarn is not clean enough in the white spun state, and the skeins after dyeing show considerable variation and uneven shade. Is there any particularly good method for preparing yarns of this kind in the dye bath, or rather, previous to dyeing? What, in your opinion, is the best cleaning agent to use for this purpose?

Answer—In order to secure the best results in dyeing skeins of worsted yarn they should be scoured previous to dyeing. Various oils are used by woolen and worsted spinners and vary with the idea of the spinner and also the market prices of various oils, and there is frequently a decided difference in the oils that may be present upon yarn. While in some cases it may be possible to dye yarn carrying a certain amount of oil, and get satisfactory results, the safest way is to be sure that the yarn is thoroughly cleansed before dyeing. This may be ordinarily accomplished by scouring in a mildly alkaline bath, at not too high a temperature—110 deg. Fahr. being sufficiently high in most instances. Along with the soap a little ammonia or potassium carbonate free from caustic potash should be used in case there is any amount of oil or grease present upon the yarn.

If the scouring was carried out in the dye bath it would be necessary, of course, to run out the scouring liquor and wash the yarn before the dyeing was started. Care should be taken to wash the yarn with water which is about the same temperature as the scouring bath before it comes in contact with very cold water. The quantity of soap and alkali necessary will, of course, vary with the character of the oil upon the yarn, but in most instances the amount of scouring reagents used should be as little as possible to accomplish the result.

M. K. Co.—*Question*—Would you kindly send us word as to what chlorinated lime would do in our dyeing water? We have a Scaife's water softening plant, and they wanted to use it for drinking purposes, and Scaife's people told them to put chlorinated lime into the water to make it pure. But since they have done so, we have had a lot of trouble with streaky yarn and uneven pieces. I have told them that it is the chlorinated lime in the dyeing, but the Scaife people do not seem to think so. We are, therefore, writing you to get your advice on the matter.

Answer—It is perfectly permissible to add chlorinated lime to water used for drinking purposes. The amount of chlorine required for this purpose is extremely small; i. e., 1.7 to 2 pounds of chlorine gas being sufficient to destroy harmful bacteria in 1,000,000 gallons of water. This would mean approximately one part of chlorine per 5,000,000 parts of water. A good quality of chlorinated lime contains 35.5 per cent available chlorine, which would require somewhat more than six pounds to give the same chlorine content as the gas, owing to the fact that all the chlorine would not be released from the bleaching powder (chlorinated lime).

We do not consider that chlorinated lime present in such small amounts would exert any deleterious effect

upon the water used for dyeing. In case an excess of chlorinated lime was present in the water and in such amounts as to be injurious to the water used in dyeing, it is our opinion that the water would not be at all suited for drinking purposes. From our perusal of your letter we conclude that no trouble is experienced in the use of the water for drinking purposes, in which case we do not believe the trouble can be attributed to chlorination of water.

Review of Recent Literature

Extra-Lustre Tram. (James Chittick, F.R.S.A., *Textile World Journal*, January 22, 1921, p. 59.)

Author finds that the ordinary degree of strength and elasticity cannot be looked for in silk after "steam stretching" or "metallic dye" treatments, and that manufacturers seeking to pay attention to the present vogue for very lustrous Taffeta, Gros de Londres, Louisine, etc., are frequently themselves to blame for unsatisfactory results instead of the dyer. On investigation of trouble it will usually be found that the tram so processed was of no higher grade than Best No. 1 (which is to-day the grade which was No. 1 before the war); also that the skeins were 10,000 yards long, and also that the mills have bought silk for this purpose without consulting the throw-silk merchant as to the use to which it was to be put. The metallic dye processing produces a higher lustre than the steam stretching, but before submitting the silk to this treatment the following requirements should be observed: The silk must be of very high quality, such as good Double Extra; the throwing must be done with special reference to the use to which the silk is to be put, so that the regularity of tension in the doubling and the regularity of twist in the spinning may be as perfect as is humanly possible; the skeins should be of short length, no more than 5,000 feet for three-thread, and less if possible, thereby enabling the dyer to spread the silk on the rollers with evenness; the amount of weighting should be kept within very moderate limits, and the work should not be entrusted to any but the most experienced dyers. After all these precautions have been taken, the author declares, difficulties are still to be looked for in the material so treated.

The Mill Man's Private Office. (*Canadian Textile Journal*, January 18, 1921, p. 38.)

There are three types of mill officials, namely, (1) he who has no private office, is always too busy consulting with half a dozen men to be approached, and when wanted must be hunted all over the mill; (2) he who has a private office and makes it so strictly private that even the superintendent has a hard time gaining an audience, and (3) he who has a private office and knows how to use it. The office of the latter can only be entered by one man at a time unless the business concerns more than one, but the superintendent gets all the time he needs and takes

precedence over anyone else. No other is allowed to go over his head in discussing any matter which it is his province to discuss with the head executive, and would-be talebearers approaching the private office are told to take the matter to the superintendent, who will in turn bring it, if advisable, to the executive. The right kind of superintendent has a private office of his own, and in large mills even the overseers are so equipped. Many matters of a more or less personal nature require privacy for their satisfactory adjustment, and the good which can be accomplished this way is very real. Many successful mill men to-day trace their start back to "confidential talks" in the executive's private office, where they were put upon their mettle. At the same time, there is a happy medium to be preserved in the number of private offices allowed, and too many will result in their becoming mere lounging rooms; but rightly used, the private office system can make for greater efficiency in the mill.

Notes on Chemical Research. (W. P. Dreaper, O.B.E., F.I.C.; 194 pages, with frontispiece; J. & A. Churchill, London, 1920; 7s., 6d.)

In consequence of the fuller realization of the value of research to the advancement of chemistry, the publication of this work, which is a second and greatly enlarged edition of the volume published by the author in 1913, should prove timely. It is divided into two parts in which "Scientific Fact and Method," and "Practical Research" are respectively considered. Something of the task which confronts the research worker is explained, and in turn the author deals with the nature of scientific knowledge, the value of observation and experiment, the necessity for care in the selection of subject matter, the necessary preliminary survey of past knowledge by a search of the records, the general procedure to be adopted, and the conditions to be observed in investigation. There are chapters on Laboratory Research and Works Research, Works Organization, Efficiency and Working Conditions, Large Scale Operations, Recording of Results, etc. Although probably of more value to the student, for whom it was primarily intended, this work also contains material of interest to those engaged in training students for research, and in any case it offers a general review of the best methods, set forth in a logical manner and in sufficient detail to make it worth while for even mature research workers to consult it as a means of keeping abreast of the latest practice and, possibly, freshening their outlook.

Process for Treating Vegetable Fibers. British Patent No. 136,569, 1920; *Gilet et Fils*.

A wool-like character is imparted to vegetable fibers by treatment at ordinary temperature with concentrated nitric acid at 65 per cent strength or over for a suitable period, less than thirty minutes, the acid being removed by washing. The process may be adapted for printing direct or by the use of reserves. Five minutes' immersion in 65 per cent acid below 20 degrees Centigrade is suitable for fine Egyptian cotton batistes.

AMERICAN DYE STUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

Professor Louis A. Olney presents a very comprehensive paper on wool dyeing in which he discusses the characteristics of wool fiber, the dyes best suited for application on wool, wool-dyeing machinery, etc.

In Part III of his article on "Chrome-Tanned Upper Leather" William C. Jackson discusses the processes used in chrome tanning and gives suggestions for handling the stock preparatory to coloring.

A most interesting article on the causes of pink stains on bleached cotton goods and methods for the prevention and eradication thereof is presented by the Testing Laboratories of Sears, Roebuck & Co., Chicago, Ill.

In Part II of his article on "Operations Preliminary to Dyeing Wool Fiber" Professor Olney discusses the methods employed in wool scouring and the reagents used in this process.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 8, No. 10

NEW YORK, MARCH 7, 1921

Section 2

A General Survey of Wool Dyeing Methods

Animal and Vegetable Fibers Compared—Characteristics of Wool Fiber—Dyes Commonly Used on Wool and Methods of Application—Acid Dyes—Mordant Dyes—Mordant-Acid Dyes—Indigo—Machinery Best Suited to Various Methods of Wool Dyeing

By LOUIS A. OLNEY

IN a recent article upon cotton dyeing the author sketched in outline the early history of the dyeing industry. In this respect what applied to cotton, in general applies to wool and need not be repeated. Attention must, however, be drawn to the fundamental fact that in ancient as well as modern times, dyers have been forced to recognize the entire difference between animal and vegetable fibers in their action toward dyes. In the early days of the industry this difference, while thoroughly recognized, was not understood, but in the light of modern chemistry the reason is perfectly clear. Both linen and cotton fiber in the purified form are composed almost entirely of cellulose, a compound belonging to the carbohydrate group and containing nothing but carbon, hydrogen, and oxygen as essential elements, *no* nitrogen being present. On the other hand, animal fibers are strictly nitrogenous, and while they contain carbon, hydrogen and oxygen, nitrogen always occurs in considerable proportion and is really the characterizing element. As a result, their reaction towards various chemicals and dyes is entirely different from the corresponding reaction of the vegetable fibers.

An excellent example of this difference is afforded in the case of the comparative action of acids and alkalis. In general the vegetable fibers resist the action of alkalis, but succumb completely to acids, while on the other hand under similar treatments animal fibers will be destroyed by alkalis, and resist the action of acids. As a result of this action certain classes of dyes which are extremely valuable for cotton dyeing are wholly unsuited for wool dyeing, owing to the fact that they must be applied in strongly alkaline baths under conditions that would destroy or seriously injure wool. This is in general true of sulphur colors, insoluble azo colors, and a large proportion of the most valuable vat dyes. In general animal fiber substance is more reactive chemically than vegetable fiber substance and this is reflected in the fact that wool has a much greater affinity for mordants

and dyes in most instances than cotton. The acid dyes, for example, which are so extensively used in wool dyeing and are absorbed rapidly and completely by that fiber in an acid bath, have no direct affinity whatever for cotton, and basic dyes which also dye wool directly will not dye cotton at all satisfactorily or permanently without the use of a tannin mordant. Furthermore, the direct cotton colors which above all other dyes are characterized by their direct affinity for cotton will dye wool more completely than they will cotton in a boiling bath, and when the two fibers are mixed in the same fabric, there is a decided tendency for the wool to be dyed more thoroughly than the cotton. The direct cotton colors also appear to possess somewhat better fastness upon wool than upon cotton.

Wool dyeing is done almost exclusively with three classes of coloring matter, the straight acid colors, the mordant dyes, and the mordant acid or afterchrome dyes. Of the vat dyes indigo alone is extensively used, and basic dyes in most instances can be replaced to advantage with various acid dyes. The direct cotton colors are extensively used in the dyeing of cotton and wool union goods, but find only limited use in straight wool dyeing because in most instances there are acid dyes which are cheaper and better for the purpose. There are, however, a few direct cotton colors which are especially noted for their fastness to washing and milling upon wool.

THE ACID DYES

The *acid dyes* are even more characteristically associated with the dyeing of wool than are the *direct cotton colors* with the dyeing of cotton. This is due to the fact that the former are not at all suitable for cotton, but the latter can be used upon both cotton and wool.

From a chemical point of view they possess a decidedly acid character, but it is not for this reason that they have been named acid dyes, as much as the fact that they must

always be applied in an acid bath to secure satisfactory results.

No individual class of dyes covers a broader range of possibilities as to variety of colors, variation in properties as far as fastness is concerned, and diversity of chemical composition.

A great variety of reds, scarlets, oranges, yellows, greens, blues and violets of remarkable brilliancy, together with many browns and blacks, may be produced as self-colors, and when the individual dyes are combined there is really no limit to the shades that may be produced. In the same way they exhibit almost any degree of fastness both to light and washing, from very fugitive to exceptionally fast in a few instances. Upon the whole, however, the acid dyes possess only moderate fastness, and we must look to the other groups just mentioned; namely, mordant, and mordant acid colors, for the most permanent dyeings upon wool. In most instances, unfortunately, we must sacrifice the highest degree of brilliancy when we pass to these other types of dyes.

Chemically, the acid dyes include a few colors of the nitro type, a very large number of azo dyes, also a considerable number of the sulphonated basic dyes. Of these three groups the first is few in number and for the most part yellows. The second group includes the most of the scarlets and reds as well as dyes of about every other color, while the last group includes the most brilliant blues, greens and violets.

In general the application of the acid dyes is simple. They are applied by a one-bath method, in conjunction with an acid usually sulphuric or acetic, and with Glauber's salt as a leveling agent. Here, as in most other cases level dyeings depend very largely upon the relative slowness with which the dye goes on the fiber. This is controlled by the quantity of acid, and stage of the dyeing process at which it is added. In cases where there is too great a tendency for the dye to be immediately and too rapidly absorbed, the dyeing may be started with acetic acid alone, and in extreme cases with ammonium acetate instead of acid, it being possible to make the latter even slightly alkaline at the start, and as the process proceeds it decomposes, with liberation of ammonia and the bath very gradually becomes decidedly acid through the presence of the residual acetic acid. In most cases the bath is made decidedly acid with sulphuric acid at the close of the dyeing operation in order that the entire amount of dye if possible may be completely exhausted from the dye bath. In this respect the acid dyes on wool act quite differently from the direct cotton colors on cotton, for in the latter case the dye can never be entirely absorbed by the fiber, no matter what process is adopted.

THE MORDANT DYES

The mordant dyes include among their number the most permanent colors for wool dyeing. They are by no means as abundant, and the variety of colors produced is much restricted as compared with the acid dyes, but few if any straight acid dyes compare with the mordant colors for fastness to light, washing, fulling, etc.

The process of application is much more complicated, requiring a two-bath method in which one complete process involves the application of a mordant and the second a complete dyeing operation in a separate bath. This necessarily makes their cost of application far greater than that of the acid dyes.

The five possible mordanting metals are tin, aluminum, chromium, iron and copper. These are usually applied in such a way as to start the operation with some soluble salt of one of these metals, known as a *mordanting principle*, and during a rather long boiling process in the presence of certain *mordanting assistants*, such as tartar, lactic acid, oxalic acid, and in some instances waste liquor from sulphite pulp mills, the final mordant becomes fixed upon the fiber, usually as an oxide or hydrate. When the wool thus mordanted is dyed in a separate bath containing the mordant dye, a chemical combination takes place between the dye and the mordant, which results in the formation of a new insoluble colored body known as a *color lake*. This color lake becomes fixed upon the fiber during the process of its formation and the wool is thus permanently dyed.

In the above list of metals tin produces the brightest color lakes and the brilliancy diminishes as we proceed with the list in just the order given, but on the other hand, tin produces the most fugitive color lakes and the fastness is increased decidedly as we pass through aluminum and chromium to iron and copper. Chromium, which appears at the middle of the list, is the most useful mordanting metal, and is depended upon almost entirely. It produces color lakes of sufficient fastness for nearly every purpose, and which possess brighter tones than are possible with either iron or copper. Sodium bichromate is commonly used as the mordanting principle.

Most of the mordant dyes are derived from coal tar intermediates, but there are at least two of vegetable origin, namely *logwood* and *fustic* which are still used extensively, and for a while during the war these vegetable dyes were the salvation of the woolen industry. Logwood has been almost entirely replaced in the cotton dyeing industry by the sulphur dyes, direct cotton colors and aniline black, but it is still extensively used in wool dyeing, and is likely to be used for some time to come, because it gives a very desirable black, with a characteristic bluish bloom which is very difficult to produce with coal tar dyes. Furthermore logwood blacks are produced at a very low cost, and although their fastness to light is not all that might be desired their fastness to milling is excellent. Fustic is a yellow mordant dye used very largely in conjunction with logwood for producing dead blacks, logwood alone on a chrome mordant giving a blue rather than a black.

THE MORDANT-ACID COLORS

The group of dyes known as the mordant-acid colors is intermediate in character between the acid dyes and the mordant dyes. They are fundamentally acid dyes in that they may be applied directly to wool in an acid bath,

but on the other hand they resemble the mordant dyes in that most of them may also be dyed upon mordanted wool. They are often spoken of as chrome colors, also as afterchrome colors, because the characterizing property common to them all is that an aftertreatment in a bath of potassium or sodium bichromate is necessary to give them their full degree of fastness, and in some instances to develop their characteristic color.

The mordant acid colors are largely a development of the last fifteen years. Some of them had existed previous to that time merely as acid dyes, but it was not until the discovery was made that certain of them could be rendered faster or converted into more desirable colors by an aftertreatment with a bichromate that a systematic study was made to ascertain why certain acid dyes possessed this property. The result of this study on the part of color manufacturers was the introduction of quite an extended group of such dyes.

One typical illustration, the group of chromotropes, will serve as an example of the rest. When applied in an ordinary acid bath they produce desirable reds possessing in some instances very good fastness to light, but upon an aftertreatment with a bichromate the reds develop into fine shades of blue possessing excellent fastness to both light and washing.

In chemical composition the mordant-acid dyes vary considerably, but a very large number of them are fundamentally related to salicylic acid, the hydroxyl and carboxyl groups playing an important part in the ease with which they unite with metals, particularly chromium, to form color lakes in the aftertreatment which follows the dyeing.

Two quite different processes are used in the application of mordant-acid dyes. The most frequently used method consists in first dyeing as a straight acid color, using acetic acid at the beginning, finally adding sulphuric acid to more completely exhaust the dye, and then subsequent aftertreating in the same or a separate bath with potassium or sodium bichromate either alone or in conjunction with some mordanting assistant such as tartar or lactic acid.

The other method known as the *chromate* or *meta-chrome process* consists in adding the chrome at the start in conjunction with the dye. If a bichromate and a dye are added directly to the bath in many instances a precipitation of a chrome color lake takes place right away in the bath, rather than later as a slow deposition upon the fiber, and satisfactory results are thus rendered impossible. To overcome this difficulty, in the meta-chrome process a mixture of sodium chrome, rather than bichromate, and ammonium sulphate is used. As the dyeing proceeds the bath, which is practically neutral at first, slowly becomes acid with sulphuric acid through the liberation of ammonia during the boiling and this sulphuric acid slowly converts the chromate into bichromate, which, being present in only a minute quantity at one time, forms a color lake with the dye which is permanently deposited upon the fiber instead of in the dye bath.

In the *chromate process* a bichromate is used but the

bath is made alkaline with ammonia at the start, thus converting the bichromate into chromate and preventing the precipitation of the color lake. With some colors, particularly for the production of light and medium shades, the dye and smaller quantities of bichromate alone may be used in the bath at the start. Magnesium sulphate is also sometimes added to the dye bath in small quantities particularly where the water is very soft.

This so-called *chromate*, *monochrome* or *autochrome process* is constantly growing in favor and has the distinctive advantage of the color being deposited so slowly that the dyer may better judge how the shade is developing, a condition which is practically impossible with the usual afterchrome process. While many of the mordant-acid colors may be applied by this process there are some which cannot be used, owing to the fact that they are readily precipitated by a chromate as well as by a bichromate.

It is also possible to mordant the wool first, by the regular process for true mordant dyes, and dye later in a separate bath with the mordant-acid color. This, however is a longer and more expensive process, and, as it has nothing whatever to recommend it, in the majority of cases, it is seldom used.

The dyeings produced with mordant-acid colors are confined almost entirely to blacks, dark blues, browns, dull yellows, olives and rather somber compound shades. The development of this class of wool dyes has greatly reduced the use of both mordant and straight acid dyes, because they satisfactorily accomplish the same purpose as many mordant dyes more easily and cheaply, and on the other hand with a slightly increased amount of labor and cost they produce far more desirable results than many straight acid dyes.

VAT DYES (INDIGO)

The only vat dye extensively used upon wool is indigo, which has for years been looked upon almost as a standard of fastness and other requirements upon wool for naval, police and firemen's uniforms. Originally, of course, indigo was a typical vegetable dye, but more recently it has become, strictly speaking, a coal tar color,

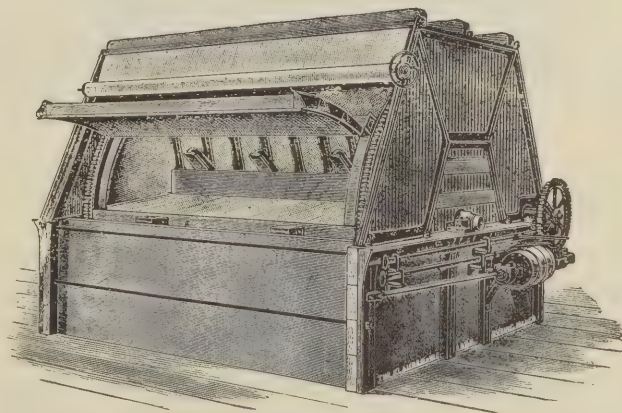


FIG. 1—Klauder-Weldon dyeing machine for loose stock

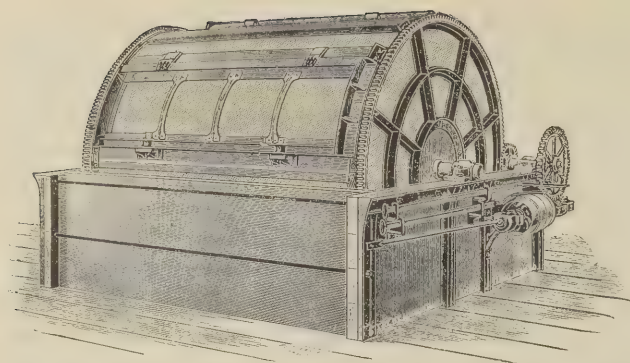


FIG. 2—Klauder-Weldon dyeing machine with top removed to show cylinder

as identically the same coloring matter (indigotin) is now made in America from American intermediates in sufficient amounts to supply all the domestic requirements. In the earlier days indigo was applied chiefly by the fermentation vat process but in recent years this has been replaced almost entirely by the hydrosulphite method, the latter being cleaner, easier to handle and more economical as far as the use of indigo is concerned.

Certain vat dyes closely related to indigo, such as thio indigo red and scarlet, may be used on wool, but their high cost without any special advantage over certain other dyes of different types which produce the same shades at lower costs, has prevented.

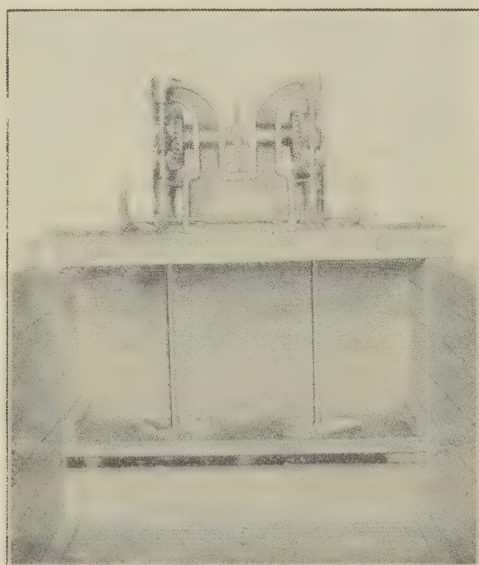


FIG. 3—Sectional view of Hussong dyeing machine, showing reversible circulators

MACHINERY USED IN WOOL DYEING

In wool dyeing as in cotton dyeing two quite different systems of machinery are used. First, the one in which the material being dyed circulates through the dye liquor, which is relatively quiescent, and second, the one in which the material itself is stationary, the dye liquor being forced through it usually under more or less pressure by means of a pumping system.

The material to be dyed may be handled in the *loose state* (raw stock), in a partially manufactured state as *slubbing* or *worsted stops*, in the spun state as *yarn*, or in the woven state as *cloth* (piece goods).

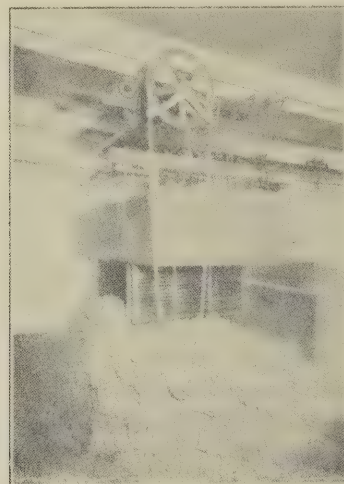


FIG. 4—Cage of Hussong machine discharging batch of raw stock

The manufacturer prefers to dye his material in this latter form as far as possible, i. e., as piece goods, because it requires the least handling and considering everything is the cheapest method. It also renders it possible for the dyer at all times to see readily just how the process is progressing, and has the advantage of giving him better control in the matching of his colors.

In many instances, however, piece dyeing is impracticable for various reasons, especially in the manufacture

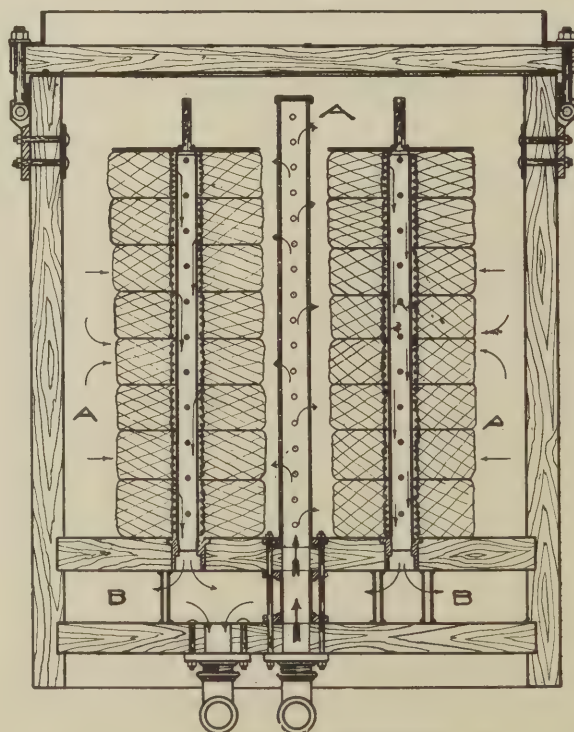


FIG. 5—Inside of Franklin top machine

of fancy goods where a number of different colors are interwoven and where certain effects resulting from the mixing of different colored fibers are desirable, as in the production of Oxford grays, by evenly mixing white with black dyed wool.

RAW STOCK

In the dyeing of raw stock the method most extensively used in the past and still used in many mills is that of working the wool by hand, with the assistance of strong wooden poles, in deep circular dye tubs which are fre-

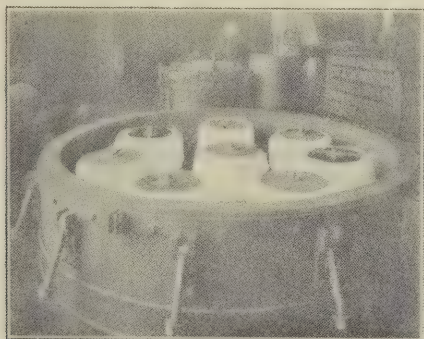


FIG. 6—Franklin top dyeing machine open

quently eight or ten feet in diameter. This method was quite satisfactory in the days of cheap labor, but with higher costs, and the necessity of more efficient methods of handling dyeing machines of various types are being introduced. Of these the Klauder-Weldon and Hussong may be mentioned as typical examples.

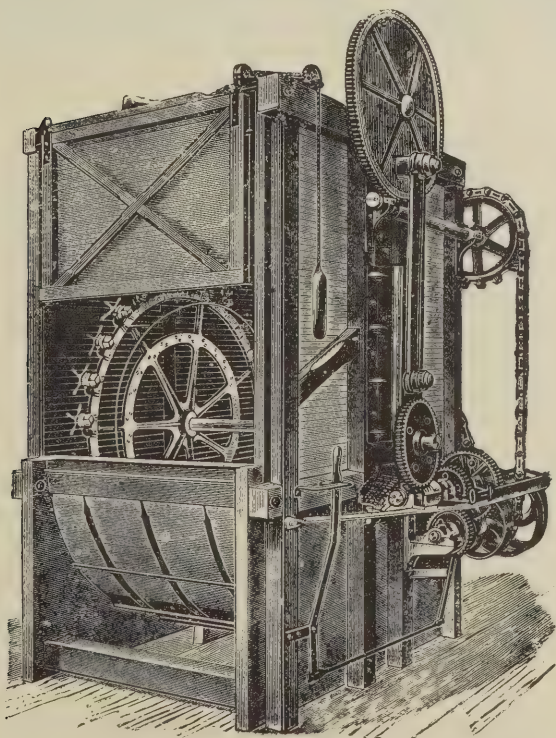


FIG. 7—Klauder-Weldon silk skein dyeing machine, showing dye-wheel in working position

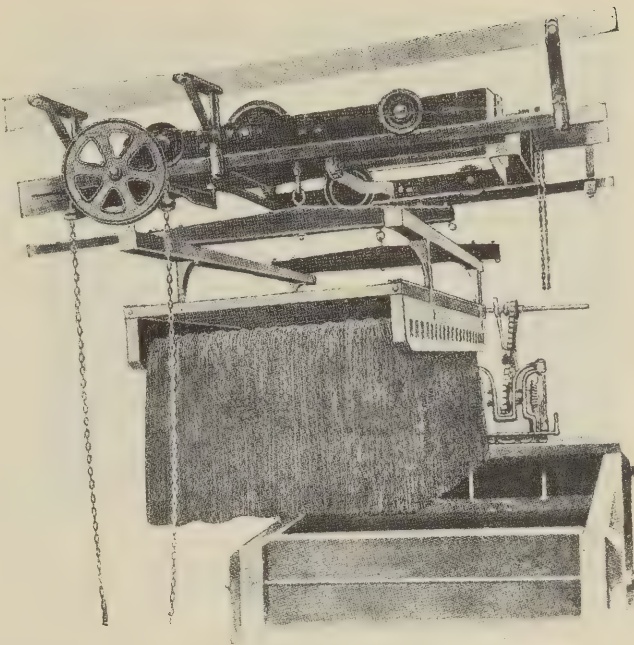


FIG. 8—Hussong dyeing machine, showing yarn rack suspended above vat

The Klauder-Weldon is of the type where the loose wool is circulated through the liquor, the former being contained in a large perforated drum which revolves in the dye liquor. The drum is divided in compartments so that the wool cannot settle down to the bottom of the drum and remain there in a more or less compact mass. The Klauder-Weldon machine in its ordinary working condition and with one of the compartments open is illustrated in Fig. 1, and Fig. 2 represents the same machine with the top removed so that its construction may be better understood.

The Hussong machine consists of a rectangular dye tub, in which a cage carrying the wool is introduced, and which remains stationary during the dyeing process. In an open space at one end of the tub (see Fig. 3) there are located propellers, something similar to those on a boat, which cause a very thorough and constant circulation of the dye liquor through the wool in the cage. The driving mechanism may be easily and quickly reversed so that the liquor will circulate in the opposite direction, although in dyeing loose wool the flow of the liquor is maintained in an upward direction during the greater part of the dyeing process. This prevents the wool from set-



FIG. 9—Section of Hussong machine, showing circulation of dye-liquor through the yarn

YARN

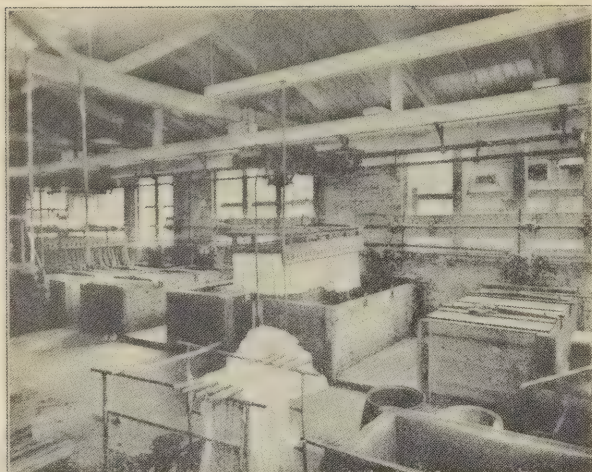


FIG. 10—Battery of Hussong skeins dyeing machines

ting down in a compact mass on the bottom of the cage. By means of a pneumatic hoist the cage may be quickly raised and transferred to other tubs or to a hydro extractor. The bottom of the cage is so constructed that the wool may be almost instantaneously dropped, as illustrated in Fig. 4.

WORSTED TOPS

Worsted tops are most frequently dyed in some special machine so constructed that the dye liquor may be circulated back and forth under pressure through the top. The Obermaier machine is one of the oldest and most used for this purpose and the Psaski machine has been used satisfactorily by some. The Franklin top machine, cross section of which is illustrated in Fig. 5 and a view of the machine packed and ready to be closed in Fig. 6, represents one of the latest developments in top dyeing.

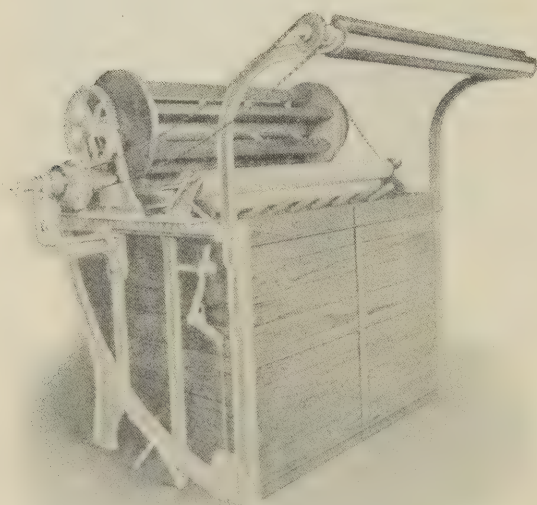


FIG. 11—Rodney-Hunt piece dyeing machine

The old method of dyeing skeins of yarn, which is still used to a considerable extent for small lots, consists in suspending the skeins from sticks the ends of which rest upon the sides of a rectangular dye tub. The skeins are turned end for end upon the sticks, at regular intervals and the sticks systematically moved from one end of the tub toward the other.

For large quantities of worsted yarn various machines are commonly used. Of these the Klauder-Weldon, Franklin and Hussong are typical illustrations.

In the *Klauder-Weldon machine* (see Fig. 7) the skeins of yarn are placed, by means of cross sticks, upon a reel which revolves in the dye liquor. The reel is so constructed that the skeins are also slowly revolved, consequently frequently changing their relative position upon the cross sticks which carry them.

In the *Franklin machine* the yarn is evenly wound upon a specially constructed spiral steel tube over which a



FIG. 12—Battery of Rodney-Hunt dyeing machines

knitted cover is placed. Varying numbers of these so-called "packages" of yarn are properly packed into the dyeing machine, the largest size of which will carry 1,000 pounds. The dye liquor is then circulated back and forth through the packages by means of a pumping system. Worsted yarn is also dyed in the Franklin machine upon jack spools, specially constructed with a perforated metal barrel.

The *Hussong machine* for dyeing yarn differs only from the type used for raw stock in that the cage carrying the loose wool is replaced by a rack, carrying skeins, which is illustrated by Fig. 8. The method of circulating the liquor through the skeins is illustrated in Fig. 9, and Fig. 10 shows a battery of Hussong skein dyeing machines with a rack full of yarn in the process of being hoisted from one of the kettles.

PIECE DYEING

The common method of piece dyeing consists in circulating the cloth in the rope form through the dye liquor. Two or more cuts of cloth are sewed together into an

endless piece, and from six to twelve of these revolved parallel to each other. They are kept in motion by means of a direct driven reel, and the revolving pieces of cloth are kept in their proper place by means of parallel pegs which project from the front of the machine.

The *Rodney-Hunt dyeing machine* which is extensively used for this purpose is illustrated in Fig. 11, while Fig. 12 shows a battery of such machines as actually installed in a large dye house. It will be noticed that these machines are set somewhat below the level of the dye house floor, and covered with large hoods, connected with a ventilating system for the removal of steam.

CONCLUSION

The development of the American dyestuff industry has, if any thing, been more remarkable along the line of wool dyes than cotton dyes, and even greater developments are expected in the near future as a result of extended research work on the part of some of the more progressive color manufacturers. At the present time, however, what is needed to permanently sustain the American dyestuff industry upon the substantial foundation which it has built during the last five non-competitive years, is adequate legislative support on the part of the United States Government and the patriotic backing of American textile interests.

Technology of Chrome-Tanned Upper Leather—Part III—Chrome Tanning

Various Processes Used and General Outlines Showing How They Are Applied—Special One-Bath Process for Ooze Calf—Suggestions for Handling Stock Preparatory to Coloring

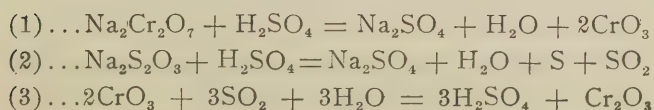
By WILLIAM C. JACKSON

Colorist with J. S. Barnet & Sons, Inc., Lynn, Mass.

DURING the last three or four decades the art of manufacturing upper leather has been greatly improved by the introduction of the so-called chrome tannage, which not only cut down the time required for tanning from weeks to a few hours, thereby saving time, labor and expense, but also produced a stronger, tougher leather, and one which gave much more uniform results in coloring and finishing.

TWO-BATH PROCESS

Chrome tanning is divided into two distinct methods. The first, or two-bath, process consists in impregnating the fibers of the pelt with chromic acid, formed by treating bichromate of soda or potash with hydrochloric or sulphuric acid. When the stock is thoroughly impregnated it is hauled out, allowed to drain, and oftentimes set out. The stock is then folded flesh out and thrown into a freshly made solution of sodium thiosulphate or bisulphite acidulated with a mineral acid, thereby liberating sulphurous acid, which in turn reduces the chromic acid on the fibers to the insoluble chromium sesquioxide, together with free sulphur. It is necessary to have the temperature of this last bath about 54 deg. Fahr. at the beginning, as considerable heat is evolved in the reaction. The chemical reactions which take place are as follows:



The pickled stock first should be opened up in a 5 per cent salt bath for ten minutes, and then add the first bath, figuring on the pickled weight, using about 5 per cent bichromate of soda and $2\frac{1}{2}$ per cent muriatic acid (22 deg. Be.). The second bath is generally made up by using about 10 per cent thiosulphate of soda (hypo) and $2\frac{3}{4}$ per cent sulphuric acid (66 deg. Be.).

As a rule, stock tanned by this process is not uniform and the second bath has to be doctored with more of the first bath liquor if the stock is too white, or with a little of the second bath liquor if too yellow. The process gives a soft, loose-fibered leather, and is still used extensively in the manufacturing of chrome kid and elk side leathers.

ONE-BATH PROCESS

The second, or one-bath, process is now generally used in the tanning of sheep, calf, cow and horse hide upper leather, as it is easier to handle, more uniform in results, and gives a firmer piece of leather, as well as better cutting for shoes, on account of the tighter flanks, and it does not "spue" as badly.

A one-bath tan liquor is generally made by treating bichromate of soda with sulphuric acid, thereby forming chromic acid, which is reduced by the slow addition of either bisulphite of soda or some organic matter such as glucose, sugar or some starchy compound.

The writer has had considerable experience, both analytical and practical, with one-bath tan liquors, and believes the best results are to be obtained by using a liquor which has been reduced with an or-

ganic compound. The best method of procedure is to add the solution of the organic compound to the solution of bichromate, thereby obtaining a colloidal solution of the chrome, and then very cautiously add the sulphuric acid, stirring constantly. By this method as fast as the chromic acid is formed it is reduced to the basic chromium salt, which, in the acid solution, is held in colloidal suspension, later to be precipitated by the addition of an alkaline sodium solution, which neutralizes the excess of acid present and precipitates the chromic oxide on the fibers in a very finely divided state. By this method leather may be tanned with as low as $2\frac{1}{2}$ per cent of actual chrome, but to obtain this result a great deal of care must be used in the making of the liquor and also in the method of tanning.

The acid should be added very slowly at first, as the reaction is extremely violent, and if too much heat is generated carbonates will be formed, which will not tan. To obtain uniform results a large quantity should be made up at one time, and is best made in a lead-lined tank, using approximately 1,000 pounds bichromate of soda, 1,000 pounds oil of vitriol and about 350 pounds organic reducing agent and water to make 1,000 gallons. (The preceding proportions, as well as all others given, are only approximate and may have to be altered to suit conditions.)

The pickled stock should be opened up in a common salt solution, which not only prevents swelling due to the acid in the stock but also seems to act as a catalytic agent, bringing about the complete precipitation of the chromic oxide.

The tan liquor should be diluted and fed in through the gudgeon in two or three feeds half an hour apart. The more acid present in the liquor the easier will it penetrate and the harder it is to fasten, whereas the more basic the liquor the less will it penetrate. Therefore, it is of prime importance that the stock be thoroughly pickled through and the liquor should be acid enough to penetrate quickly. About half an hour after the last of the tan liquor has been added, if the stock is thoroughly penetrated, it is a very good plan to start adding the solution of the alkaline carbonate in a very fine stream, taking about one hour for the operation. Enough soda (preferably "Snowflake Crystals") to insure a complete precipitation of the chrome on the fibers is advisable, and at the same time care should be taken not to use too much chrome liquor nor too much water.

TANNING PROCESS FOR OOZE CALF

To obtain satisfactory results in the making of ooze leathers it is absolutely necessary to have a tannage which will produce a supple piece of leather without being loose-fibered. If tanned by the two-bath process it is impossible to obtain a short nap. If the one-bath process is used the nap is close but the stock is too firm and requires so much staking to properly

soften it that it makes the nap woolly, which is not to be desired. Therefore, the logical solution of the problem is to use a tannage which is a combination of the two processes, wherein the properties of one are moderated by those of the other. The following method of tanning will produce very satisfactory results, if properly handled and adjusted to suit existing conditions:

Put 700 pounds drained pickled stock in a drum containing 30 pounds salt dissolved in twenty pails of cold water. Run ten minutes

On the day previous dissolve 35 pounds sulphate of alumina (free from iron) in 3 gallons boiling water in a tank. In another tank dissolve 35 pounds sal soda with direct steam. Add the boiling sal soda very slowly to the boiling solution of alum, stirring constantly, and then boil this mixture until the whole becomes a milky solution. This should make about two pails and should be diluted to make 24 gallons with cold water.

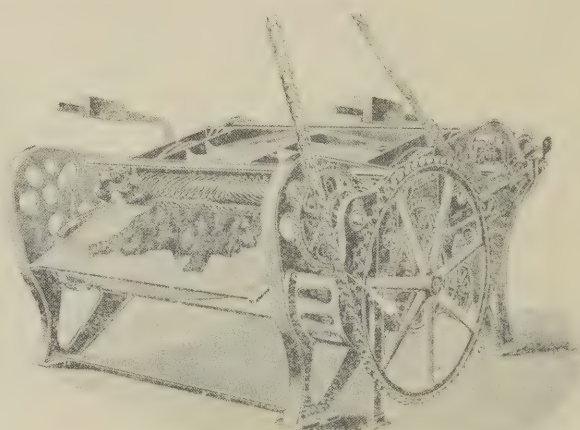


FIG. 1—Putting-out machine, class B—the Turner Tanning Machinery Company

After the stock has been thoroughly opened up, add the above alum and soda mixture to the salt bath and run half an hour, and then let the stock stand for half an hour in this liquor.

Dissolve 7 pounds bichromate of soda in 2 gallons hot water and dilute to make 6 gallons. Start drum and add this solution through the gudgeon, and run half an hour and rest half an hour.

TAN LIQUOR

On the day previous dissolve $22\frac{1}{2}$ pounds bichromate of soda in 6 gallons of cold water in a barrel, and then add $5\frac{1}{4}$ pounds oil of vitriol (66 deg. Be.), and stir well. While stirring add very cautiously 6 gallons bisulphite of soda (36 deg. Be.). Dilute this liquor to 24 gallons and divide it into three feeds.

Add the first feed through the gudgeon and run half an hour, and then rest twenty minutes, and so on, until the three feeds have been added. Next feed in

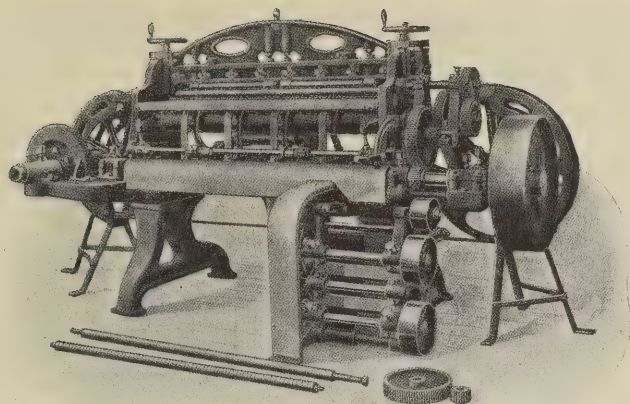


FIG. 2—Splitting machine for limed or tanned stock—the Turner Tanning Machinery Company

very slowly 28 pounds bisulphite of soda (36 deg. Be.) diluted to make two pails. (Great care should be taken at this point that the bisulphite is added slowly, or the stock will heat up too much and draw the grain. Some heat is necessary, but not over 125 deg. Fahr. If you find stock heats too much, you may either dilute the bisulphite more or feed in slower.)

Run half an hour and rest half an hour, and so on, until the stock is tanned, when it should be horsed up overnight and the following day washed for one hour in running cold water. If at night the stock is not tanned, add enough water to cover stock and let stand, and next morning run for ten minutes and then horse up.

The object of the alum and soda bath is twofold—it not only neutralizes the pickle but also has an astringent effect on the stock, making the grain tighter and thereby producing a close-fibered leather, which is essential in ooze calf. If used on grain-finished leathers it may be better to cut down the amounts used if the grain appears drawn.

The bichromate of soda is used as a secondary two-bath tannage, uniting with some of the acid of the

subsequent tan liquor, forming chromic acid, which later is precipitated by the bisulphite of soda on the fibers, as in a two-bath process.

PREPARATION FOR COLORING

When samples cut from the heaviest parts of the stock will stand boiling for three minutes the stock may be considered as tanned, and should be either horsed up or piled on platform trucks overnight. The next day it should be put in wash-wheels and washed with running cold water for one hour, or preferably neutralized for half an hour with $\frac{1}{2}$ per cent borax and then washed half an hour with running cold water. Put out on the flesh on a Turner putting-out machine and sort out heavy stock for splitting, either on a Union splitter or on a belt-knife splitting machine. The next day stock is ready for shaving, after which it may be piled down and the following day assorted for weights and grades and made into units for coloring.

In shaving ooze calf a 4 to 5 pound skin should be used and great care should be taken to shave very clean and get under the veins as much as possible.

With side leather it is oftentimes found expedient to retan the stock before coloring, in which case it should be neutralized with 1 per cent borax, figured on the shaved weight.

(To be concluded.)

BLUES ON SILK

For the production of various shades of blue on the silk fiber, it is a curious fact, declares *Posselt's Textile Journal*, that indigo is the only source of natural origin that is particularly available.

It is, of course, possible to produce dark blue shades upon silk by means of yellow prussiate of potash in connection with a grounding of ferric oxide. This so-called Prussian blue, on silk, while of itself a solid and brilliant shade, lacks, however, the property of level dyeing. This is due mainly to the fact that it is practically impossible to boil off the silk so that it is clear in every part of the skein. For this reason, Prussian blue dyeings on silk are of no value.

As to indigo, the use of the soluble indigotines and indigo extracts supplies many of the common wants of the silk dyer. It is possible to dye silk in the vat, this being in fact a revival of a very old method of dyeing silk, but one that calls for knowledge gained by experience.

Apart from the preparation and care of the vat-liquor, the building up of indigo shades on silk requires considerable skill on the part of the dyer.

To produce a given shade of blue with indigo is very different from dyeing the same shade by means of aniline colors, which can be used at once for the full shade. With the indigo vat, however, the dyer must repeat the immersion of the skeins a sufficient number of times until the proper depth of shade has been attained.

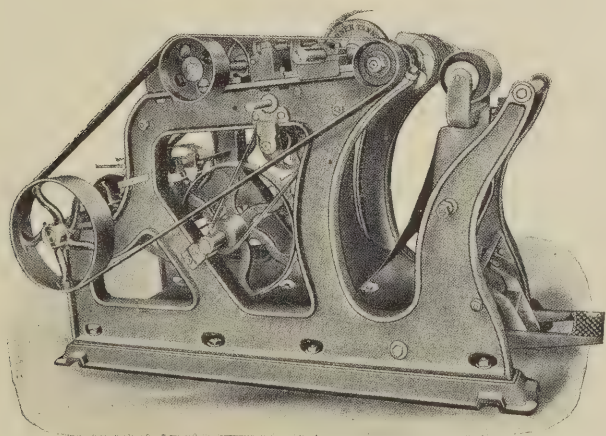


FIG. 3—Shaving machine—the Turner Tanning Machinery Company

Operations Preliminary to Dyeing Wool Fiber

Part II—Practice of Wool Scouring

A Discussion of the Generally Accepted Methods of Wool Scouring, Together with Comment on the Characteristics and Properties of the Reagents Commonly Employed, with Special Reference to the Value of Various Soaps

By LOUIS A. OLNEY

TWO different processes of emulsive wool scouring naturally result from the conditions already mentioned—first, one in which the wool is extracted with warm water previous to its introduction into the alkaline scouring liquor; and, second, one in which the wool is introduced directly into the alkaline soap scouring bath, without any previous washing with water.

FIRST METHOD

The first method is commonly used when it is desired to recover the potash salts occurring in the suint. These form a valuable raw material for the manufacture of various potassium compounds and, from an economic point of view, should be recovered; but expensive equipment, and its incident bother and supervision, has too frequently caused this phase of the industry to be entirely overlooked. Wool-scouring establishments on the continent of Europe frequently have extensive plants for this purpose, but they are practically unknown in America.

By this method the wool is first treated with warm water in a series of extraction tanks, usually four in number, and so arranged that the process known in industrial chemistry as "methodical extraction"⁶ may be applied. Various forms of continuous scouring machines may also be used to advantage for this purpose. This first step is commonly called "steeping," and in principle involves nothing but the solvent action of water. Upon its completion the wool is ready

for the actual scouring operation. This differs so little from the second method, a description of which follows, that it need not be separately described.

SECOND METHOD

In America as well as England this second method is used almost exclusively, no attempt being made ordinarily to recover either the potassium compounds or the wool grease.⁷ The preliminary steeping is therefore omitted and the combined suint and wool grease removed in one scouring operation, commonly carried out in one of the continuous scouring machines, which will be described later.

By many it is thought that the potassium salts accompanying wool are entirely lost by this method; but they cannot be considered as wholly so, for, being present to some extent as soluble soaps and naturally slightly alkaline in character, their presence in the scouring bath aids in the removal of the wool grease and thus diminishes the amount of soap necessary. On the other hand, this advantage is partly counterbalanced by the fact that the scouring bath becomes so quickly soiled that it has to be renewed oftener than in the first method.

REAGENTS USED IN WOOL SCOURING

The reagents available for wool scouring are the carbonates of potassium, sodium and ammonium, potassium and sodium soaps, ammonia and sodium sili-

⁶ Methodical extraction as applied to wool steeping consists in passing the extracting water through the raw wool contained in a series of tanks which we will designate as A, B, C and D. Assuming that the water enters A first, and then passes through A to B, and from B to C, and finally C to D, it is evident that all the soluble matter will travel in the direction of the current of water. The wool in A will therefore become extracted first, and when completely extracted it is removed and replaced by raw wool. The water is then passed through B first and A last, the order becoming B, C, D and A. After the next addition the order becomes C, D, A and B, and so on. In this way the clean water, which has the greatest solvent action, is constantly coming in contact with the cleanest wool, and the dirty extracting liquor, which is laden with soluble matter and has the least solvent action, comes

in contact with the dirtiest wool. The water is usually circulated by means of rotary pumps, and its course through the different tanks controlled by a system of valves.

⁷ When the naphtha extraction process is used the wool grease is entirely recovered, and a few works using emulsive scouring processes have adopted the method of adding sulphuric acid to the spent scouring liquor, thus liberating the fatty acids of the scouring soap, and along with them a portion of the wool grease. Mechanical separators of the centrifugal type, working upon the same principle as cream separators, are also being adopted by some of the large wool scourers for the purpose of making at least a partial separation of the wool grease.

cate. Ammonium chloride is used by some wool scourers, and occasionally sodium chloride (common salt). Caustic potash or caustic soda should not be used.⁸

Potassium carbonate (K_2CO_3), known commercially as potash or peal ash, has, as a rule, been given preference over sodium carbonate for scouring the best grades of wool. In general, wool scourers have considered that potassium compounds have less deteriorating action on wool and are less likely to turn it yellow than the corresponding sodium compounds. This has been attributed to the fact that wool is always accompanied by the comparatively large quantities of potassium compounds occurring in the suint and, being accustomed through all ages to the presence of potassium compounds, has lost some of its sensitiveness to their action. Some believe that this preference for potash compounds is a fallacy and that sodium compounds give just as good results. Potassium carbonate is decidedly deliquescent, and therefore becomes soft in a moist atmosphere and has a tendency to cake in a very dry atmosphere. It also costs, depending upon the condition of the market, from three to five times as much as sodium carbonate. For these reasons it has been replaced very largely by sodium carbonate.

Sodium carbonate (Na_2CO_3) occurs commercially in several different forms. Soda ash is the commonest and occurs in two forms—the 58 per cent, which contains 90 per cent of Na_2CO_3 , and the 48 per cent, which is reduced with common salt ($NaCl$) or Glauber's salt (Na_2SO_4), for special purposes; monohydrate crystals ($Na_2CO_3 \cdot H_2O$), the normal carbonate with one molecule of water of crystallization; soda crystals or washing soda ($Na_2CO_3 \cdot 10 H_2O$), which contains ten molecules of water of crystallization. For wool scouring dependence is placed almost

entirely upon 58 per cent soda ash, the monohydrate being occasionally used. There are also upon the market a number of so-called modified or neutral sodas which consist of varying mixtures of sodium carbonate with sodium bicarbonate. They are somewhat milder in their action than straight soda, and dissolve more readily and are less likely to absorb moisture and cake. Their solutions have a greater solvent action upon soap than the solutions of soda ash, and they are therefore effective in rinsing soap from goods that have been scoured with soap. They find special uses in the scouring and cleansing of textile material, and might frequently be used to advantage in wool scouring. Their higher cost per unit of alkali, however, has probably curtailed their use to some extent.

Soda ash is more likely to contain free caustic soda than any of the other forms mentioned above, and its presence should be carefully guarded against.⁹

Ammonium carbonate [$(NH_4)_2CO_3 \cdot H_2O$] is a white crystalline powder, rather unstable, losing ammonia when exposed to the air and forming ammonium bicarbonate ($NH_4 \cdot H \cdot CO_3$). A similar reaction takes place when the normal salt is dissolved in water. Ammonium carbonate is formed when various nitrogenous substances decompose. Ammonium carbonate was the active scouring agent of "laut" or stale urine, which in former times was so extensively and effectively used in wool scouring.

Ammonium carbonate is an excellent wool-scouring agent, and one which never produces any serious action upon the wool fiber. With it a higher temperature may be used than with either sodium or potassium carbonate, but its high cost has restricted its use.

Soaps.—Chemically speaking, soaps are the metallic

⁸ It is by far safest to adopt the rule of never using caustic potash or caustic soda in wool scouring. It is a fact, however, that some wool scourers have been known to add small quantities of caustic soda to the wool scouring bath without any serious results and, in their minds, to advantage. It always introduces a decided element of risk, however, and is too much like playing with gunpowder: sooner or later something unpleasant occurs. To be sure, caustic potash and caustic soda both have a more energetic action upon the grease and oil which accompanies wool than any of the other reagents mentioned above, but at the same time they have a far more destructive action upon the wool fiber. A comparatively dilute solution of caustic soda will completely destroy wool fiber at elevated temperatures in a few minutes and seriously tender it at lower temperatures. The only reason that such a procedure is at all successful is due to the fact that the coating of wool grease upon the wool is sufficient to more or less completely exhaust the action of the caustic soda before it reaches the actual wool fiber, providing the caustic is present in a sufficiently small

quantity. There are always, however, exposed portions of the fiber which may be attacked, to the detriment of the final condition of the wool. It may remove grease quickly and effectively, but always to the detriment of the wool.

⁹ Test for caustic soda in sodium and potassium carbonate: Dissolve a small amount of the sample of carbonate (2 grams will be sufficient) in from 25 to 50 c.c. of water, and add to this solution a few drops of phenolphthalein indicator, whereupon the solution will become a deep bluish-red color. Next add an excess of a concentrated chemically pure barium chloride solution, whereupon a heavy precipitate of barium carbonate forms. If no caustic is present the mixture soon becomes milky white, but if even a small amount of caustic is present it retains a decidedly pinkish appearance, no matter how great an excess of barium chloride is added. The persistent pink coloration is due to presence of the soluble barium hydrate, of a decidedly alkaline character, which is formed when the caustic alkali reacts with the barium chloride.

salts of the higher fatty acids. The only common metals forming soluble soaps are potassium and sodium, most of the others forming insoluble soaps, which in every wool-scouring process are objectionable and to be avoided. The higher fatty acids which most frequently enter into the manufacture of soaps are:

Stearic acid ($C_{17}H_{35}COOH$)
 Palmitic acid ($C_{15}H_{31}COOH$)
 Oleic acid ($C_{17}H_{33}COOH$)
 Lauric acid ($C_{11}H_{23}COOH$)
 Linoleic acid ($C_{17}H_{31}COOH$)

Of these the first three are by far the most important in soap manufacturing. They occur in varying proportions in most of the common animal and vegetable oils and fats in the form of glycerides, which are the glyceryl salts of these acids. When the glycerides of these oils are treated with caustic soda or caustic potash, the process known as saponification takes place with the formation of a sodium or potassium soap, as the case may be, and the liberation of glycerine. Sodium soaps usually permit of the complete separation of the glycerine and dry out perfectly hard, while in the manufacture of potassium soaps it is found impossible to practically separate the glycerine and most of it remains in the soap. As a result, potash soaps, which are naturally softer than soda soaps, become much more so owing to the tendency of the glycerine to absorb and hold water.

The common fats and oils used in soap making are:

Vegetable—

Olive oil
 Palm oil
 Coconut oil
 Cottonseed oil

Animal—

Tallow oil (mutton and beef)
 Lard oil
 Bone oil or grease

The best grades of soap for wool scouring are made from olive oil, lard oil and cottonseed oil. Soap made entirely from olive oil possesses excellent wool-scouring properties. It is readily soluble even in moderately warm water, does not gelatinize, penetrates well and is easily washed from the wool, but is ordinarily too expensive for general use. Soaps made from olive oil in conjunction with other oils rich in olein are extensively used. In fact, soaps made from almost any of the oils and greases mentioned above may occur in varying quantities in scouring soaps. When cottonseed-oil soap is present care should be taken that it has been made from an oil free from resinous matter that may give rise to yellow stains; and, furthermore, it must be thoroughly washed out, or a disagreeable smell will develop upon drying and hot pressing.

Palm-oil soaps are extensively used as textile soaps, but much more extensively as fulling soaps than for scouring purposes.

Soaps made entirely from cocoanut oil are highly characteristic. Cocoanut oil is one of the most complicated oils, containing no less than six different fatty acids. It is not readily thrown out of solution by salt, and for this reason is sometimes used with sea water under the name of "marine soap." If properly made it scours woolen material very thoroughly without causing it to shrink. The introduction of varying quantities of cocoanut oil in the manufacture of wool soaps is beneficial in many cases.

All soaps used in wool scouring should be well made—i. e., free from unsaponified matter, should be neutral and absolutely free from caustic alkali.

Sodium silicate (Na_2SiO_3) may be obtained commercially in the solid form, or as a thick syrupy solution known as water glass. While very effective in the scouring of vegetable fibers, it is not especially recommended for use in wool scouring, as it has a decided tendency to yellow the fiber and leave it in a harsh condition.

Ammonium chloride (NH_4Cl) (sal ammoniac) has met with favor with some wool scourers. Its value lies in the fact that in conjunction with soda ash it readily liberates ammonia, which is a valuable wool-scouring agent. It also acts readily with any caustic soda or caustic potash that may be present in the alkali, forming common salt and liberating ammonia. In this way it tends to exchange a very harmful ingredient for one of recognized value.

Sodium chloride ($NaCl$) (common salt) is believed by some wool scourers to be a valuable addition to the scouring bath, although no wholly satisfactory explanation has ever been offered as to why it should be. In general, it tends to reduce the solvent action of the bath for soap, and through the introduction of small quantities of magnesium chloride as an impurity wastes some of the soap through the formation of an objectionable insoluble magnesium soap. Physical chemists explain any benefits resulting from its use on the theory of the "common ion," in that the mixture of alkali and common salt is mild in its action as compared with that of straight alkali.

As to which of the above scouring agents should be used in any particular case depends upon the grade of wool that is being scoured, the properties or quantities of the wool that must be retained after the scouring is completed, and the cost.

For the best grades of wool it has been generally believed that a neutral potash soap in conjunction with potassium carbonate (free from caustic), occasionally with addition of ammonium carbonate or a little aqua-ammonia, gave the most satisfactory results. Sometimes the potassium carbonate is omitted from this combination and sometimes the ammonia.

With cheaper wools sodium soaps and sodium car-

(Continued on page 26.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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A TECHNICAL SETBACK

THE curtain has rung down on the final act in the drama of Futility staged by the United States Senate and the Dye bill. With the passing of the Sixty-sixth Congress as an official body, it retires leaving undone that which it could have accomplished in a very short period and which was a solemn duty owed to the nation. It makes no difference that the next Congress will pass the bill. The mischief resulting from nearly two years of uncertainty cannot be set right. The valuable time which might have placed us a great deal farther along the road to complete independence in our coal-tar chemical industries but which was not made to yield anything like its full measure of benefit because of the demoralizing effect of the uncertainty upon the trade, has gone, never to return.

In the last issue of the weekly REPORTER the opinion was stated that nothing short of a miracle could get the Dye bill passed before the closing of the session. Almost as the lines were being written Representative Longworth was telling newspaper correspondents that no further effort would be made to get it through, and that he purposed offering it as a part of the revived Payne-Aldrich bill to be brought up next session as a stop-gap tariff until a general scientific tariff bill can be prepared and passed. Meanwhile there is to be another conference between proponents and objectors for the purpose of reaching some sort of an agreement. More than a week ago Senator Penrose told those interested that if differences could be patched up the bill should be passed before the session ended. The objectors were the ones who refused to hold the conference, automatically eliminating the bill's last chance for consideration before closing time. This is but another shining example of the sort of opponents the bill has. In England, precisely the same proposition was put to both parties by Lloyd-George; the meeting was held and the bill became a law

in less than a month. Never have foes of the Dye bill been able to offer effective arguments against it; their sole weapon has been the prevention of a vote being taken, either by filibustering or by such tactics as those mentioned above. This is sufficiently strong testimony as to their knowledge of where they will stand when the vote finally comes.

Do not forget that conference. You can and must take part in it. We could use an entire column and fifty repetitions trying to impress this upon you without making it nearly so clear as through the use of one simple sentence: WRITE to your Congressman and your Senators; tell them you favor the Dye bill and urge favorable, speedy action. Remember to write to *both* Senators and your Representatives, since the bill must again pass through Congress.

Also remember that letters from constituents get more attention from public servants than any other form of appeal, and—do it now!

WHERE SHALL THE LINE BE DRAWN?

APPARENTLY the incident of the vanishing dye experts, who successfully disappeared from Germany one day toward the end of last year and, after eluding both German and Dutch authorities, turned up at Ellis Island and later at Wilmington, is not a closed one. The reader will recognize Drs. Joseph Flachslander and Otto Runge, who are now safely ensconced in the Du Pont Dye Works. Their apprehension is being sought by the German Government, together with that of two others, Drs. Heinrich Jordan and Max Engelmann. The last two had also signed contracts with the Du Pont company, engaging to come over here and assist in the production of coal-tar dyes, which their extensive experience with F. Bayer & Co., of Leverkusen, well fitted them to do.

Drs. Flachslander and Runge, it will be remembered, were detained at Ellis Island on complaint of the Dutch consul, who declared that his government had accidentally discovered a trunkful of secret formulae and valuable notes on dye processes, and that the men were wanted by the German Government for the illegal appropriation of recipes to which they had access by reason of their positions of trust while with Bayer. At that time the detained dye experts declared that they had no written formulae with them and that their contribution to the Du Pont company would consist of nothing but the cumulative results of their experience. Since no evidence could be found among their effects, and since their passports had been vised by the American consul abroad and were quite all right in every respect, they were allowed to enter. Now the latest report says that the alleged trunk of formulae was seized by the Dutch authorities who discovered it, and was sent back to the prosecuting attorney at Cologne, while Drs. Jordan and Engelmann cannot be found.

An interesting situation is developing. It is evident that the two dye experts who got away safely

did not have any written formulae with them when they landed; but the German Government still "wants" them, ostensibly because of what they tried to do, and actually because Germany will have none of her own subjects "selling out" to America or any other country—even to the extent of experience and training. This is certainly the most eloquent way of saying that these men can undoubtedly do a great deal of good to the American dye industry if they are so minded, and particularly if it is their intention to become citizens and settle down here, as so many of their countrymen have done in the past. And it is also good evidence that Germany still has designs on the American dye markets—as if evidence of *that* were wanting! But whether or not Germany will be able to compel their return for trial is a question for which the answer will be awaited with some attention, not only in the dye trade but among the public generally, who appear to be agreeably diverted by the whole controversy.

When the chemists arrived in this country The REPORTER opined that one of the principal services which they might be expected to render was a "speeding up" of the production of types not yet mastered—the possible saving of many such experiences as that told of by Mr. Klipstein before the Senate committee—and the stand was taken by this publication that if these men could be of real benefit to the American industry their presence in an American dye plant was justified. But Dr. Charles H. Herty, whose opinions we respect mightily and who should certainly know whereof he speaks, declared editorially that their presence would lower the morale of the Du Pont research staff, transforming it into "a conglomeration of incompatibles, a hybrid mixture which has in it the elements of failure." Dr. Herty was for sending them back on the next steamer, conceding that during the progress of a war information is obtained from captured opponents, but arguing that renegades are not placed in positions of high command, and that the fact of Drs. Runge and Flachslander having been engaged in the production of German high explosives and poison gases for use against Americans would engender much bitter feeling among American chemists forced to come in contact with—and even take directions from—them at the Du Pont plant.

We are reluctant to believe that the reaction of the Du Pont staff to the introduction of these men is quite as bad as Dr. Herty pictures it; but we are well aware, nevertheless, that all the arguments and theorizing in the world cannot overcome one tangible, concrete fact which says "No!" to all one's laboriously evolved conclusions. And when dealing with a personal equation it were better to discard all the rules of mathematics before beginning.

Hence, if the German importations are going to throw the Du Pont staff into a turmoil, become the subject of weekly indignation meetings, and cause a spirit of revolt among the workers—why, no one can

get around the fact, and it is possible that the itinerant chemists may turn out to be more of a liability than an asset.

The REPORTER scarcely needs define its position with regard to the German dye barons; it most certainly holds no brief for the Germans in general nor for Drs. Runge and Flachslander in particular. For this reason we dare to say that such intense feeling against a couple of refugee dye makers—if it exists—seems unnecessary at this time. Where shall the line be drawn? Regardless of the "war" on paper which the Senate has been maintaining with Germany for so long, either the World War is over or it is not. Either business is to be resumed as rapidly as possible, or it is not. The general idea seems to be that the World War is over and that trading is to begin. The whole question, under such conditions, ought to hinge on whether or not these men have anything we want. Dr. Herty admits that there is now an industrial war on hand which is quite as real, quite as ruthless, in its own way, as was the other. Renegades who have held high positions may not actually have been placed in high command, but they *have* directed others in high command, and it has always been considered part of the game. If the Leverkusen gentlemen have anything we want, we should feel no undue squeamishness in taking it. Their presence is one of the logical results of the modern idea of reconstruction. If that idea is not going to be carried out without a fuss, then we ought to pack them off home, ban performances of German opera, stop importations of German toys—and the sale of such toys as have been kept during the war, in which considerable business was done last Christmas—and declare an absolute prohibition, from now on, of all importations of German dyes. No one is obliged or even requested to *love* these men now wanted by the Cologne police! In the war which began on the day the armistice was signed it will most surely be a case of best man win and "devil take the hindmost." In this war of the dyes, open hostilities have merely been postponed; both forces have spent their time in trying to maneuver the big Senate siege gun around into a position where it could be fired off at the other side. We managed to get it trained on the Rhine valley and loaded it, but as yet it has failed to go off. Time is infinitely precious, and during such a period of uncertainty anything which can hasten our preparedness ought to be seized. If it is all right for American textile industries to use German dyes and German dyers, it is all right for American dye manufacturers to use German training to make them independent of such things the sooner.

Associates of Drs. Runge and Flachslander are merely asked to stifle their feelings long enough to enable them to learn things which they would eventually find out, but only, in all likelihood, after months spent in wasting time and materials. There is nothing dishonorable or unpatriotic in taking what you can get under such circumstances, any more than there is

in making use of captured German patents. And if it seems in any way disloyal to the men who fought the war to associate with former dealers in poison gas—in order to get something which America needs for the further ultimate confounding of the industry which introduced such a weapon to the world—it may be as well to remember that the German dyes now coming in, and which the Longworth bill will let in under license, were also produced in the plants which made the German explosives and gases. Then see if you can say just where to draw the line!

And so, let us repeat: If our "Young Visitors" have information which they are willing to part with, take it. If not—well, as Dr. Herty has suggested, there are eastward-bound steamers constantly traveling across the Atlantic.

MEDICAL RESEARCH IN THE DYE INDUSTRY

IT will be recalled that a comparatively recent report of the medical director of E. I. du Pont de Nemours & Co. on health hazards of the color industry mentioned as injurious concentrated nitric and sulphuric acids and mixtures of these two, nitrous fumes, and products formed by the action of the mixed acids on members of the benzene series, which poison by inhalation or absorption through the skin. It is not always possible, the report stated, to trace a case of poisoning to a particular substance, but dinitrobenzene, ortho and para toluidine, the diamines, phenylglycine ground with aniline, and Magenta and rosaniline colors, have all poisoned workmen more frequently than other products in the Du Pont plant. In the case of some employees it has been found that personal idiosyncrasy is very marked, and men thus constituted should not be allowed to come in contact with poisons.

The conclusion of the report was that the hazards of the color industry are no greater than those of other industries, provided that the buildings are properly equipped and ventilated, that the workmen are carefully selected, and adequate medical supervision is maintained. The last is extremely important, since it should be the duty of the examining physician to apply tests which would prevent susceptible individuals from being wrongly placed. Fortunately, medical supervision in various industries is to-day better than it ever has been, and the color industry is no exception. Yet as the safeguarding of the health of workers becomes more efficient, so that the general problems of working conditions, individual tendencies, etc., obtaining in all classes of endeavor become so well understood as to bring practically all troubles arising from these sources into the "preventable" class, the necessity for extensive research by industrial physicians looking to the prevention or treatment of special diseases peculiar to certain industries becomes increasingly apparent. Much has been done and is being done, yet there is work enough for many lifetimes, and new problems are arising and will

continue to arise as science advances and new processes and chemicals replace old ones.

Such a problem, not newly arisen, but concerning which the available data is still inadequate, is provided in our own industry by the prevalence of cancer of the bladder among coal-tar dye workers. As far back as 1895 the frequency of this disease among workers in the industry was observed in Germany, but as the data secured at that time was considered to be insufficient to warrant definite conclusions as to its cause, it has remained for more recent investigators to establish it as unquestionably due to the occupation.

One of the recent developments in the international search for causes of cancer is the establishment of the fact that chemical irritation is just as capable of producing malignant growths as is mechanical irritation. Coupled with this came two German reports published in 1920 showing a startling number of cases of this disease. In one, the Nassauer report, eighty-nine cases of bladder cancer among aniline dye workers were reported, while in the other twenty cases were told of, four of which, however, were apparently included in the Nassauer report.

Hospital records for Basle and Frankfort also bear out these findings of the high incidence of the disease among coal-tar color workers, and the long period of incubation. Twelve out of sixteen cases operated upon in the University clinic at Basle from 1901 to 1910 occurred in persons doing this work, and of ninety-two cases treated in a surgical clinic at Frankfort from 1895 to 1918, twenty-two were dye workers.

The interval between the first exposure and the first appearance of the symptoms is a long one—usually about fifteen years, and sometimes as long as twenty-eight years, although one of the cases was reported to have developed about two years after exposure. It has been found that the disease has developed in a number of cases in individuals who were former dye workers but who had for years been following some other occupation, thus indicating that early injury to the bladder from this cause persists until cancer develops; although as the majority of the victims were between the ages of thirty-four and forty-seven, it also indicates that "exposure" can frequently take place before the age at which cancer is likely to develop.

One of the reasons why the data is still unsatisfactory is the fact that it is extremely difficult to determine the true proportion of cases among the dye workers, or the length of exposure which is dangerous, owing to the long period which it takes for the disease to develop and the shifting about of workmen. On the other hand, the fact that twenty-eight cases were found in a plant employing but 105 workmen—if all were due to occupational causes—is an indication of the high rate. Nassauer believes that exposure to the more dangerous substances for more than three months is unsafe, but it is interesting to note that he also believes that this danger can be largely avoided by proper hygiene and by the use of devices to prevent unnecessary contact with materials.

It is likewise difficult to determine the different substances which may be responsible for producing the disease, although the theory has generally prevailed that aniline and benzidine are the most important agents. Nassauer, however, believes that aniline alone is responsible, yet no experimental evidence has as yet been actually secured to show that cancer of the bladder has been caused by aniline or any other chemical used in the industry. But the evidence furnished by the statistics is regarded by most as sufficient to indicate that this disease can truly be classed among the occupational diseases of the dye industry.

The world will some day have a cure for cancer; we may depend upon it. It may come next month, next year, or in the next decade. There are a number of claims being made right now, but if any be true cures, they have not had time as yet to come into general use. Meanwhile, assuming the correctness of Nassauer's beliefs, it would seem as though much might be done in the way of correcting conditions causing "exposure" of workmen—particularly among owners of inadequately equipped plants—and that earnest attention to research for the more definite determination of those conditions is in order among the larger manufacturers.

OPERATIONS PRELIMINARY TO DYEING WOOL FIBER

(Continued from page 22.)

bonate replace the potassium compounds, with no apparent detriment. In fact, during the war, owing to

the scarcity and high price of potash compound, these sodium compounds were used largely upon the higher grade wools with no great detriment. Sodium silicate is not extensively used, as it has nothing to specially recommend it. Ammonium chloride has met with considerable favor with some scourers, but sodium chloride is only occasionally used. Both may have advantages, particularly the former, but the latter should be used with moderation.

The quantities of these chemicals that should be used in any particular case vary to such an extent, depending upon the nature of the wool being scoured and also the composition of the soap, that it is impossible to give any exact figures or attempt to establish any fixed rules. The apparatus used for scouring and its arrangement also modifies the use of the scouring agents somewhat, and this subject will be discussed later with more detail under the heading of "Processes and Machinery Used."

With wools containing an excess of lime as a mechanical impurity, or in the case of "pulled" or "slipe" wool, which sometimes contains as high as 5 to 7 per cent of lime, a preliminary treatment with dilute hydrochloric or sulphurous acid is recommended, as the lime if allowed to remain will waste large quantities of soap and also interfere with subsequent dyeing operations.

(To be continued.)

Pink Stain on Bleached Cotton Goods

Important Warehousing Problem Solved—Pink Stains Discovered to Be Attributable to Aniline Vapors and to Be Removable by Powdered Ammonium Carbonate

Prepared for the AMERICAN DYESTUFF REPORTER by the Testing Laboratories of Sears, Roebuck & Co., Chicago, Ill.

A PIECE of chemical detective work recently carried out by the testing laboratories of Sears, Roebuck & Co. has solved at least one phase of a problem which has been bobbing up in the textile field more or less frequently for years. It is known rather generally that pink stains have from time to time mysteriously appeared on various kinds of cotton goods, either in the bleacheries, in warehouses, or supposedly in transit by ocean or rail. The laboratory chemists of Sears, Roebuck & Co., through the simultaneous discovery of several examples of pink stain in the company's warehouses, came into possession of more than the usual amount of data and were able to discover a unique cause of the difficulty and devise an inexpensive and easily applied remedy for getting rid of the color without refinishing the goods. The story is as follows:

Recently some white cotton flannelette nightgowns

showing well-defined pink stains were sent up to the laboratory by the baby goods department as representing the condition of most of the garments in a case which had just been delivered from the warehouse. A few days later two other examples of pink color, one on white sheets and the other on bolts of sheeting, both of them direct from our warehouses, were submitted. This accumulation of evidence naturally pointed the finger of suspicion toward some warehouse condition as the source of trouble, and our investigation was taken up in this direction.

Turning first to what was already known on the subject, our records showed that this mystery had already made its appearance in the laboratory three times, once with a shipment of white garments to our Seattle branch, again with some goods received in Chicago from an East-

ern manufacturer, and a third time with a shipment of linens from England. The literature on the subject brought out the fact that pink stains on bleached cotton goods had been an intermittent source of trouble in the textile industry for several years. In fact, these stains had developed under such widely different conditions that there were evidently several kinds, differing in their reactions and calling for different assumptions on the part of the textile chemists as to their probable cause.

For example, one kind of pink stain was known to be due to a certain mold; another had been proved to be caused by manganese existing as an impurity in bleaching powder. Again, it had been claimed by some that the pink color had resulted when ultramarine blue was used as a whitener if any acid were left in the goods after bleaching. Others blamed the use of aniline dye tints, which they contended were a blue and red combination, the blue, being unstable, fading out and leaving the pink or red predominating. It had further been demonstrated that aniline fumes, traced to aniline compounds, had been responsible for pink stain in a number of cases at the bleacheries.

It is not our purpose, however, to go into these chemical reactions but merely to relate the circumstances of the pink staining of bleached goods in our own warehouses and to show how we were able to positively identify the agent most active in producing the stains. In the development of our solution of the problem a few laboratory experiments were carried out which are recorded here, as they throw some side lights on the situation and may be of interest to those who are making a study of the chemical reactions which produce pink stains in bleached cotton goods.

This experience of Sears, Roebuck & Co. emphasizes the fact that the counsel of a chemical laboratory can be of distinct service in controlling the warehousing of miscellaneous merchandise so that no classes of goods will be stored for any length of time near other kinds of merchandise which might be affected thereby. We feel that this suggestion is particularly opportune, in that there is undoubtedly more merchandise in warehouses at this time than ever before and much of it may be stored longer than has been the rule in the past.

ANILINE VAPORS FROM AUTOMOBILE TIRES CAUSED STAINS

To return to the examination of the warehousing conditions, it was soon discovered that all of the cases of merchandise showing the pink stain had been stored in a warehouse on the same floor with, and surrounded by, a number of skeleton cases of paper-wrapped automobile tires. An examination of other cases of bleached goods in the neighborhood of the tires proved that nearly every case opened was contaminated. The fact that the inspected cases had been stored for several months in the same room with the tires, and the knowledge that the rubber industries used aniline and aniline compounds as vulcanizing accelerators, led us to suspect that the

aniline vapors given off by the tires might be the chief agent in the formation of the pink stains. Our suspicions were strengthened by finding a yellowing action on the wooden merchandise cases, a previous experience of the writer having proved that aniline fumes stain paper and soft pine wood a yellow color. To prove the presence of aniline fumes in the warehouse atmosphere, advantage was taken of the well-known fact that a pink color is produced when solutions of fufural and aniline acetate are brought together. Pieces of plain cotton and cotton goods were first moistened with a very dilute solution of fufural, and then the air near the tires in one of the warehouses was aspirated through these pieces. A beautiful pink color was immediately produced.

In order to establish the connection between the aniline vapor and the pink stains on the fabrics a large piece of bleached unstained cotton sheeting was placed among the tires, and in seven days the sheet showed a decided pink tint. (This piece of sheeting was allowed to remain among the tires for about a month, at the end of which time the stain had progressed so far that the goods would have passed as a pink dyed fabric.) To further prove the connection, inspection was made of several cases of bleached goods stored in two other warehouses in proximity to rubber tires. In every instance where the goods had been stored for several months near the tires the pink stains were present. Evidently, then, three factors governed the amount of pink staining—type of bleached goods, their proximity to rubber tires, and length of time stored. Those fabrics which were extremely well bleached and of the better quality seemed to show more pinking than the filled or unbleached fabric. In fact, it was found that unbleached material was not affected by the aniline fumes, although some of the cases examined had been longer in contact with the aniline atmosphere than those containing the better quality of bleached goods showing pink stains. (This aniline atmosphere did come from the rubber tires, as proved by the laboratory work noted below.) Examination of a few other cases containing woolens, silks, linens, etc., showed no pink stain.

There being no doubt that the automobile tires were directly responsible for the pink stains, a recommendation was made at once to our warehouse department to segregate all cases of tires and other rubber goods either on separate floors or preferably in a separate warehouse.

FUFURAL NOT RESPONSIBLE FOR STAINS

While the warehouse inspection was proceeding other tests were being carried out in the laboratory. Since fufural is produced by the action of hot dilute acids on cellulose or starches, and since, from some of the above reactions, fufural in connection with aniline might have caused our pink stains, it was thought desirable to try to produce fufural in the goods. Samples of cotton and cotton goods were exposed simultaneously to aniline

fumes and sulphur dioxide in one test, and to aniline fumes and sulphur trioxide in another test. These gases were used because there was a strong possibility that they might be present in the warehouse atmosphere in very small quantities and, as both of these gases with water vapor form sulphuric acid, the acid so generated might produce fufural in the goods.

These experiments resulted in yellow instead of pink stains being produced, and all laboratory tests were unsuccessful in the reproduction of pink stains, which would confirm the possibility of fufural being formed in the warehouse. A test made on cotton and cotton goods which had been moistened with a dilute solution of fufural, and then dried, did not give a pink color when exposed to aniline fumes, or even when tested with aniline acetate solution, thus proving that the fufural had volatilized. Our tests show that in order for the pink stains to be caused by fufural and aniline, the fufural must be produced in the fabric in the presence of an atmosphere of aniline fumes. Pink stains were readily produced in pieces of goods when placed in a solution containing a few drops of aniline oil, to which was added a small quantity of dilute sulphuric or hydrochloric acid. We were unsuccessful in all our laboratory tests in producing a pink stain with aniline fumes except where moisture and acid were present.

Seventeen samples of different kinds of bleached goods from several bleacheries, and a sample of U. S. Standard raw cotton were placed in the warehouse in the atmosphere surrounding the tires, with the following tabulated results:

No.	Type of Fabric	Days Exposed	Results	Starch Test
1.	Long cloth	35	No change	Positive
2.	Indian Head	8	Very pink	Positive
3.	Indian Head	8	Very pink	Positive
4.	Standard sheeting...	35	Pink	Positive
5.	Plisse	35	No change	Positive
6.	White suiting or butcher linen	35	No change	Positive
7.	Standard sheeting...	35	Very light pink	Positive
8.	Standard sheeting...	35	No change	Positive
9.	Percale sheeting	35	No change	Positive
10.	Standard sheeting...	35	No change	Positive
11.	Standard sheeting...	8	Pink	Positive
12.	Standard sheeting...	21	Pink	Positive
13.	Birdseye diaper cloth	8	Pink	Negative
14.	Fine muslin	35	No change	Positive
15.	Cotton suiting	35	Pink	Positive
16.	Nainsook	35	No change	Positive
17.	Flannelette	35	Slightly yellow	Positive
18.	U. S. Standard raw cotton	35	No change	Negative

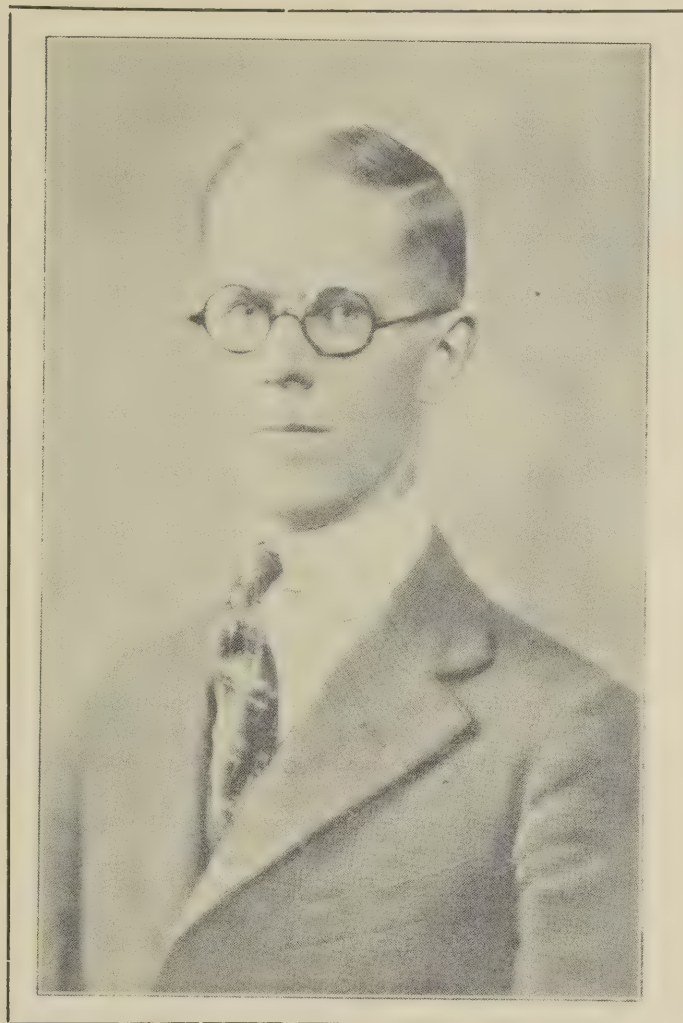
All of the seventeen fabrics listed above were tested before exposure with dilute starch iodide solution to see if any chlorine had been left in the goods when

bleached, for chlorine in conjunction with aniline fumes causes pink stains. No chlorine was found in any of these samples. The samples were also tested for starch and, while most of those containing the most starch showed the pinkest stains, there were instances where fabrics giving only a faint starch reaction had turned pink.

POWDERED AMMONIUM CARBONATE BEST ANTIDOTE

We were, therefore, unable to arrive at any definite conclusions as to the cause of the pink stains other than the aniline fumes, and it did not seem wise to make further research, as it was felt there must be something in the process of bleaching unknown to us which might explain the phenomenon. Of course, the particular development of the problem most important to our merchandising departments was some suitable method for the removal of the stains. Although the alkaline reaction of soap or a very dilute solution (0.1 per cent) of sodium carbonate would permanently remove the stains, it was evident that the goods could not be washed without spoiling the finish. Since washing methods were not feasible, the use of a gas suggested itself, and the bleaching actions of practically all of the more commonly known gases were tried out. While some of these were more or less effective, nothing as inexpensive and efficient as ammonia gas was found, the only trouble being that the results were temporary, a faint pink color returning in a short time. Furthermore, wherever the stains were heavy, as along the folds, a slight yellowing effect was produced. In the end, the best results were obtained by the use of powdered ammonium carbonate, which removes the stains with less yellowing effect than that produced by straight ammonium fumes. With powdered ammonium carbonate, it is merely necessary to open the top of each case and scatter about 1 pound of powdered fresh ammonium carbonate along the sides of the case and in between the bolts of cloth. The case must then be closed and in from twenty-four to forty-eight hours the stains will have disappeared. While the stains are probably not permanently removed by this method, they will not return in less than one month, and the method is safe and simple.

In conclusion, while the complete chemical reactions which caused the pink stains were not discovered, these were really not an essential feature of the research. The two important points brought out in this case were the active cause of the pink stain (the automobile tires) and the method of their removal (powdered ammonium carbonate). It seems also that a valuable warehousing principle has been brought out in this connection, namely: *that rubber goods of any form should be segregated from all textile or other kinds of merchandise which might be affected by their aniline fumes.* While not every case of pink stain reported may be of this variety, it is hoped that the conclusions reported above will be of value and that they may lead to the solution of other difficulties of similar nature.



MEN OF MARK in the DYESTUFF FIELD

Harold M. Chase
Superintendent of Dyeing
Riverside and Dan River
Cotton Mills
Danville, Va.

HAROLD M. Chase was born in Lowell, Mass., in 1872 and received his early education in the public schools of that city. He says that the exceptionally interesting and comprehensive course in chemistry given in the Lowell High School by Dr. Cyrus Irish was largely responsible for his having turned to chemistry as a profession. In 1890 he entered the Massachusetts Institute of Technology and graduated from that institution in the courses of both chemistry and chemical engineering, receiving the degree of S. B. in each instance.

In 1895 Mr. Chase went to Wilmington, N. C., as chemist and overseer of dyeing in the Wilmington Cotton Mills, where he remained until 1908. During this time Mr. Chase directed the establishment of an independent plant controlled by the Wilmington Cotton Mills for the purpose of dyeing raw cotton for the various hosiery mills which were then springing up throughout the Carolinas. Their process was at that time unique and was practically identical with the modern beam dyeing machine method except that they used cotton laps on perforated cores instead of beams. They also devised an effective method of mercerizing cotton warps and skeins.

The dye plant was destroyed by fire and the mills sold in 1908, whereupon Mr. Chase continued to associate himself with the former owners in various capacities, particularly in the development of a process for the utilization of pine stumps and waste wood by distillation to produce turpentine, creosote oils and other marketable products.

In 1917 Mr. Chase assumed the position of chemist with the Riverside and Dan River Cotton Mills, and upon the retirement of the late W. G. Benefield, the former superintendent of dyeing, in 1918, Mr. Chase became his successor, which position he still holds.

Mr. Chase is unquestionably one of the best known and most highly esteemed textile chemists in the South to-day. His mill is the largest in the Southern territory and its dyeing department is generally recognized as being one of the most successful and best managed of its kind in the country.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

C. C. P.—Question—I am enclosing small sample of what was intended for a combination shade of tan on loose wool, using the following acid dyes, etc., on 100 pounds of wool:

- 1¼ oz. orange
- ⅝ oz. yellow
- ⅜ oz. black
- 6 lb. Glauber's salt
- 1 lb. sulphuric acid

Entering the material in the bath at about 140 deg. Fahr., without the sulphuric acid, the orange went on rapidly when near the boil. As the bath began to boil spots of green composed of the black and yellow began to appear in the wool. After boiling about fifteen minutes the sulphuric acid, well diluted, was added and completed the exhaustion of the bath, the liquor being practically clear at the end of forty-five minutes.

I will appreciate any advice you can give me that will help to remedy this uneven dyeing, as we frequently have this trouble in a lesser degree.

Answer—We are inclined to think that there are several different factors which might have led to the poor results you experienced in this dyeing.

In the first place, we imagine that the wool was either not properly scoured and thoroughly cleaned before entering the bath, or else had been partially carbonized with sulphuric acid and not properly neutralized thereafter. It would be well to make sure that the wool is thoroughly scoured and rinsed before entering it into the dye bath.

In the second place, although you do not mention the exact nature of the colors which you have used, we assume that they are not what are known as level dyeing acid colors. The wide difference in hue between the yellow, orange and black is so great that, in our opinion, this is not a wise combination to use for producing a light shade of tan, and we think perhaps a better assortment could be selected.

So far as we know there is not on the market at the present time any black which dyes level with sulphuric acid, but there are certain blues which work well with yellow and orange to produce shades of tan.

As specific directions for producing this tan shade we

would suggest the following: First make sure the wool is thoroughly scoured. Second, enter into the bath at not to exceed 120 deg. Fahr. with 1 pound of sulphuric acid already dissolved in the bath. Bring very slowly to a boil, taking at least twenty minutes to reach boiling point. After boiling has continued for half an hour, exhaust the bath by the gradual addition of another pound of sulphuric acid in dilute solution. If level dyeing colors are used this should produce satisfactory results. If you find it necessary to use the same colors which were used on the sample submitted, we would suggest that the dye bath be prepared at 120 deg. Fahr. with 2 pounds of acetic acid instead of 1 pound of sulphuric acid, and then proceed as outlined above.

C. C. D.—Question—Can you tell me whether or not there are any methods for preventing woolen hose from shrinking? I understand such a method is in use in England, but do not know where to get information regarding it.

Answer—We do not know of any method which is really satisfactory for this purpose. It is obvious that if woolen hose are dyed after knitting at the boil for an hour or more and allowed to dry in an unstretched state, practically all shrinkage which could possibly occur at the home laundry would have taken place. It is generally the practice of hosiery mills, however, to dry their hose, after dyeing, on frames, which, of course, prevents the last bit of shrinkage from taking place but is necessary in order to have them come out properly sized. If similar methods were taken in laundering—that is, drying the hose on forms—there would be no difficulty; neither will there be much difficulty, in any event, if a neutral soap and only moderately warm water are used. English goods are sometimes styled "London Shrunk," but we do not believe there is anything more to this method than the use of exceptional care.

A. M. P.—Question—How can I dye artificial silk the best way? Whenever I try to boil the colors level, the skeins tangle so badly it cannot be wound.

Answer—It is very easy to obtain a line of colors that do not have to be boiled, but which will dye artificial silk at 100 to 120 deg. Fahr. Cold dyeings have very little tendency to become uneven and there should be no further difficulty with tangled skeins.

M. H. Y.—Question—I am using an acid black of American manufacture corresponding to Naphthol Blue Black and dye with acetic acid and Glauber's salt. I have great difficulty in getting evenness and penetration but I understand that other dyers have no trouble. How can I remedy this?

Answer—The remedy is to use more Glauber's salt and less acid, giving the dyeing operation more time. The amount of acid should be adjusted so that almost a full hour is needed to exhaust the bath. When you have arrived at this state the evenness and penetration will correct themselves.

Review of Recent Literature

Chimie de la Teinture. Prof. Antonio Sansone 460 pages; J. Hermann, Paris; 40 francs.

This is the French edition of Prof. Sansone's "Chemistry of Dyeing," which was to have been published in 1914, but which was delayed by the war. The present volume is profusely illustrated and is accompanied by a book of patterns containing 215 samples of prints and dyeings on a wide variety of goods. Although wanting an index, the volume is furnished with a detailed table of contents which helps to replace it, although the reader would have been better served had the index not been omitted. The treatment of the subject matter is very thorough and the new book is a worthy addition to the other works on prints and dyeing by Prof. Sansone.

"Recovery of Grease from Waste Liquor." (Lecture by J. H. Garner, Huddersfield; *Textiles*, February, 1921, p. 27.)

While the recovery of grease and fertilizers is not such a productive proposition as it was during the war, one may anticipate, the author believes, that the results will eventually again approximate those of pre-war days. The chief sources of recovery are: (1) Effluents from textile processes, such as wool washing and piece scouring; (2) sewage of towns engaged in the textile industries; and (3) materials such as sud-cake, shoddy waste, cotton waste, greasy cleaning waste, leather clippings, etc. Effluents from wool washing contain a considerable quantity of grease, averaging from 1 to 1½ tons per 25,000 gallons of effluent, while this quantity of effluent also contains one-quarter to one-half a ton of potash. The recovery of potash from the effluents of washing processes as now carried on cannot be achieved economically. It has been established beyond a doubt that grease recovery when carried out on right lines is a profitable undertaking; and while numerous methods have been tried, none has shown the slightest sign of displacing the oldest method, the acid process. The simplicity of this process has caused it to be neglected in many cases, with the result that considerable quantities of grease are allowed to run to waste, analysis of many samples of effluents from recovery plants showing that there are a number in operation which regularly permit the escape of from 20 to 40 per cent of the recoverable grease. Under proper conditions as much as 95 per cent of the total grease should be recovered. Author describes the acid process and emphasizes the following points for successful working: (1) The suds should be perfectly cold before the acid is added, otherwise some of the grease forms an emulsion and is separated slowly and with difficulty; (2) the quantity of vitriol in excess of that required to neutralize the liquid should be between 50 and 100 parts per 100,000 of the

liquid; and (3) after the addition of the acid the contents of the tanks should be thoroughly mixed, with at least twenty-four hours for settlement. Author further discusses the sulphate-of-iron process recommended by the Royal Commission on Sewage Disposal, and finds that in the few cases where it was tried eventual abandonment in favor of the acid process followed. In the treatment of sud-cake from the steam pressing of magma, the percentage of grease varies from 9 to 30 and can be extracted profitably.

"Preparing Fibrous Filaments for Dyeing." U. S. Patent No. 1,348,167; 1920; Eugene S. Graves.

This patent describes a method of preparing fibrous filaments for dyeing or other processes, and consists of winding the filaments into a package in combination with a separate strand or strands of cotton yarn, with the windings laid helically of the axis of the package and maintained independent of each other.

"Testing Yarns and Fabrics." (Dr. J. Herzfeld; 206 pages, 5 x 8½; New York, D. Van Nostrand Company.)

This is the third edition of this successful work, which contains new material, the whole being carefully translated from the German and revised so that the arrangement of division headings stands as follows: Microscopic examination of textile fibers; chemical examination of textile fibers; determining the yarn number; testing the length of yarns; examination of the external appearance of yarns; determining the twist of yarn; determining the tensile strength and elasticity; estimating the percentage of fat in yarn; determination of moisture (conditioning); determination of the mode of weaving; distinction and combination of warp and weft threads; testing the strength and elasticity of a fabric; ascertaining the count of warp and weft threads in a fabric; determination of shrinkage; examining the constituents of the warp and weft; determination of the dressing; estimation of the waterproof properties of cloth; determining hygroscopicity; testing the fastness of the dye; measuring the length of piece goods; determination of mordants and dyes; and the detection and estimation of arsenic.

"Application of Dyestuffs Containing the Sulphoamide Group in Dyeing and Printing." British Patent No. 149,428; 1920; J. W. McMyn.

Process sets forth that azo dyes containing no sulphonic or carboxylic groups, but instead the sulphoamide group ($-\text{SO}_2\text{NH}_2$ or $-\text{SO}_2\text{NHR}$), are obtained by coupling a diazotized aminophenyl-sulphoamide with an amine or phenol. These dyes may be dissolved in caustic alkali solutions, and in this state may be applied to fabrics. The dyes are precipitated and fixed on the fabrics afterwards by treatment with carbon dioxide, bicarbonates, ammonium salts, weak acids, or alum, and the dye solution may be thickened to a degree suitable for calico printing if desired.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 8, NO. 14
APRIL 4, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

In the third instalment of his article on "Operations Preliminary to Dyeing Wool Fiber" Professor Louis A. Olney dwells upon the temperature of the bath and the machinery used in wool scouring.

In an article entitled "Garment Cleansing and Spotting" Walter J. Bailey, Jr., gives an outline of the methods followed in a modern cleansing plant, together with specific recipes for the removal of various stains on textile fabrics.

"A Brief Resume of Writing and Printing Inks" is the title of an article by Walter E. Hadley, in which the author touches upon the historical and chemical sides of this subject.

The final instalment of William C. Jackson's treatise on "The Technology of Chrome-Tanned Upper Leather" deals with the coloring and finishing of this product.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 8, No. 14

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Section 2

Operations Preliminary to Dyeing Wool Fiber Part III—Temperature of Bath and Machinery Used in Wool Scouring

A Discussion of the Conditions Which Control the Temperature of the Wool-Scouring Bath, and a Description of the Modern Types of Wool-Scouring Machinery

By LOUIS A. OLNEY

A COLD scouring bath has very little solvent and emulsifying action upon the accompanying substances of wool, but as the temperature of the bath is raised the solvent and emulsifying action increases and, from a theoretical point of view, would become the greatest at a boiling temperature.

INFLUENCE OF TEMPERATURE ON THE ACTION OF SCOURING AGENTS

In wool scouring, however, another element enters into consideration; namely, the action upon the wool of the scouring agents other than water that are in the scouring bath. At a low temperature these reagents have but slight deteriorating action upon wool, but as the temperature rises this action increases, and at a boiling temperature the combined action of soap and alkali is energetic enough to seriously tender the wool.

A temperature must therefore be used in wool scouring that will be sufficiently high to give the scouring solution an energetic solvent and emulsifying action, but at the same time sufficiently low to prevent the soap and alkali from seriously injuring the wool.

Experience shows that temperatures of 110 to 130 deg. Fahr., depending upon the character of the wool and the scouring agents, are best. Above 130 deg. Fahr. there is not only danger of felting the wool and of detracting from its luster and feel, but of seriously reducing its strength. Temperatures below 110 deg. Fahr. are not sufficiently high to soften and properly emulsify the wool grease, or rapidly dissolve the suint. In most cases the temperature is not allowed to go much above 120 deg. Fahr.

The temperatures mentioned above have been established through observations, by wool scourers, of the re-

sults obtained upon different types of wool and with different scouring agents, but the accompanying "graph" (see Fig. 1) gives an insight into the reason why these temperatures have proved to be the best.

"FACTOR OF SAFETY" IN TEXTILE MATERIAL

In reality a "factor of safety," so far as tensile strength is concerned, is involved in the manufacture of textile material. Bleached cotton cloth, for instance, frequently diminishes decidedly in tensile strength as compared with the gray cloth, and frequently scouring, dyeing and finishing processes, for one reason or another, impair the strength of both cotton and wool fabrics. In general it has been considered that a fabric likely to become tendered should have sufficient initial strength to permit its losing a maximum of 20 per cent of its original tensile strength without seriously impairing its commercial value. A loss of 10 per cent in tensile strength should not seriously injure any well-made fabric.

Applying these limits of 10 and 20 per cent loss in strength to wool fiber, we find from actual experiment that it works out somewhat as is shown on the following "graph," where the solid line represents the tensile strength of the wool fiber and the dotted line the relative solvent and emulsifying action of the scouring liquor. The percentages at the bottom represent total tensile strength of the fiber, while the figures at the right represent the temperature of the scouring liquor.

An observation of the continuous line curve, which represents loss of tensile strength, will show that between 110 and 130 deg. there is a loss of from 7 to 20 per cent. An observation of the broken line curve, which represents the efficiency of the scouring bath as to solvent and emulsifying action, will show that it

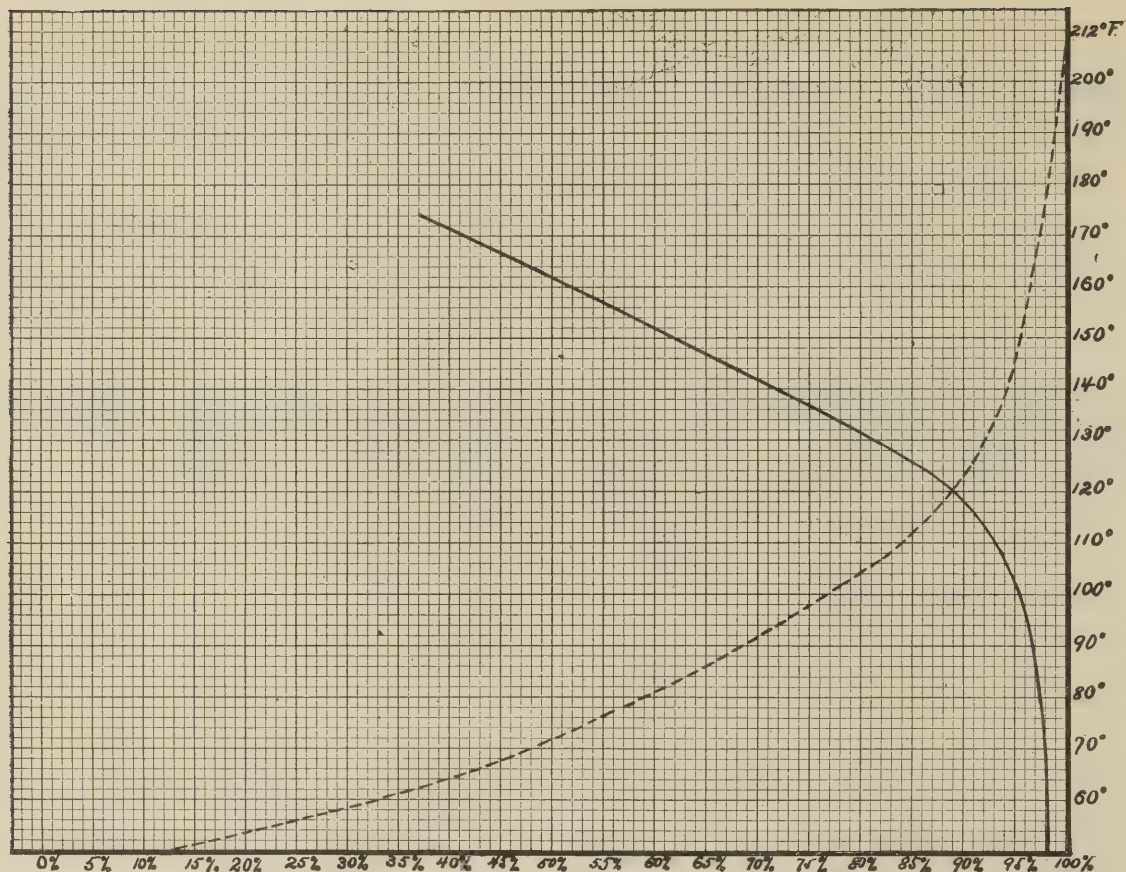


FIG. 1
Graph Showing
Relation of
Temperature of
Wool Scouring
Bath to Loss of
Tensile
Strength of
Wool

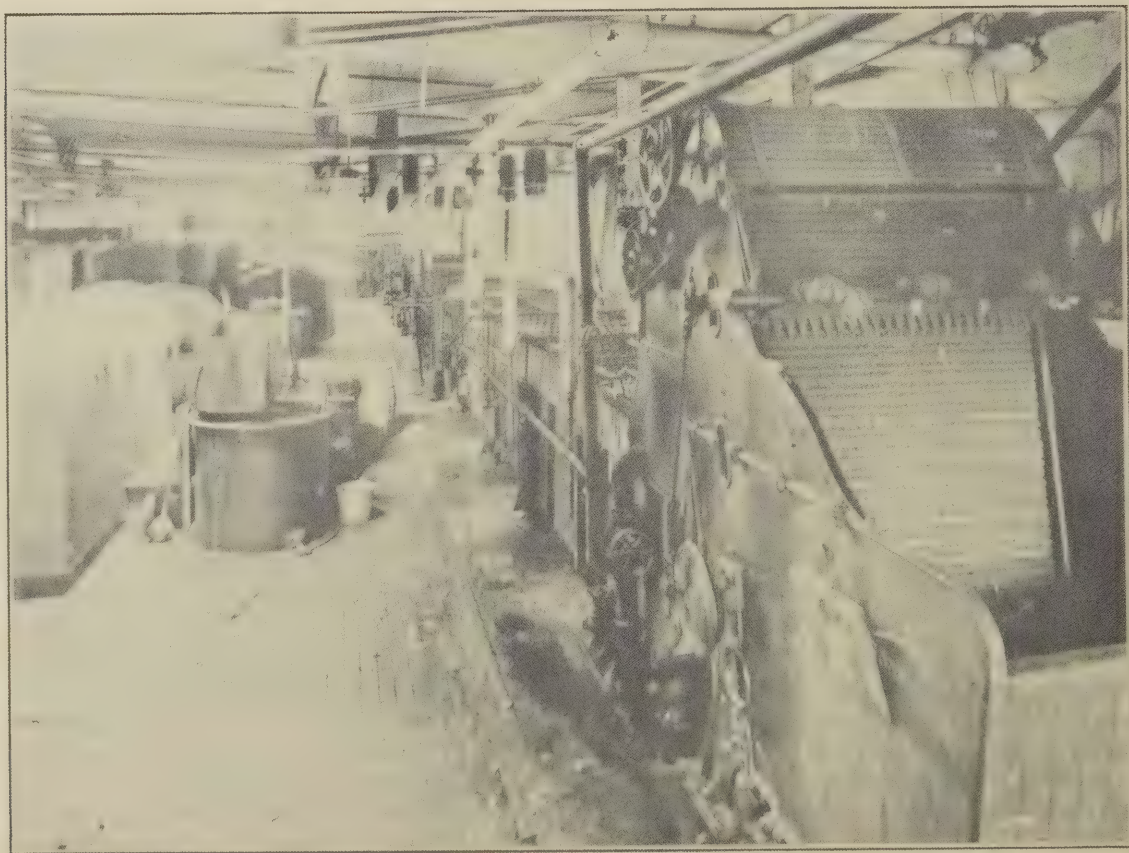


FIG. 2
Installation of
Three Bowl
Wool Scouring
Machine at
Stirling Mills,
Lowell, Mass.—
C. G. Sargent's
Sons Corp.

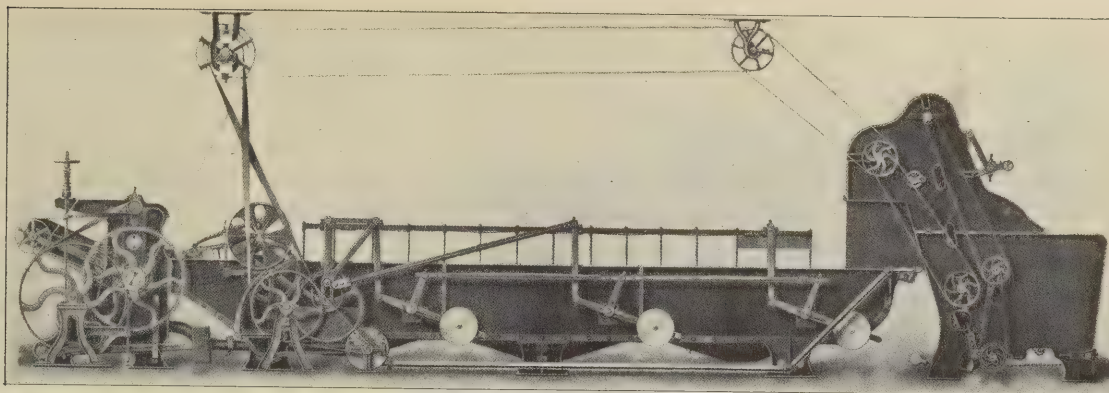


FIG. 3—Scouring Machine of the Rake Type—C. G. Sargent's Sons Corp.

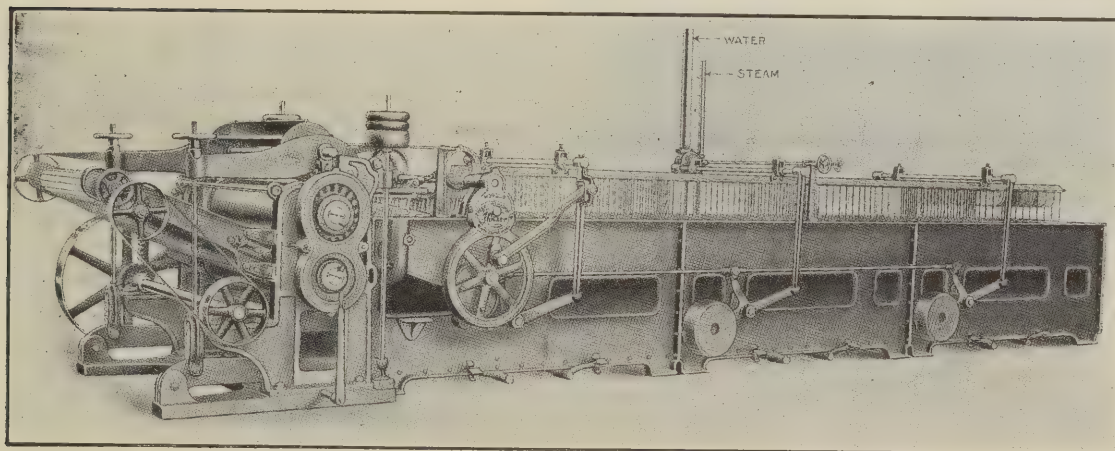


FIG. 4--Scouring Machine of Rake Type—James Hunter Machine Company

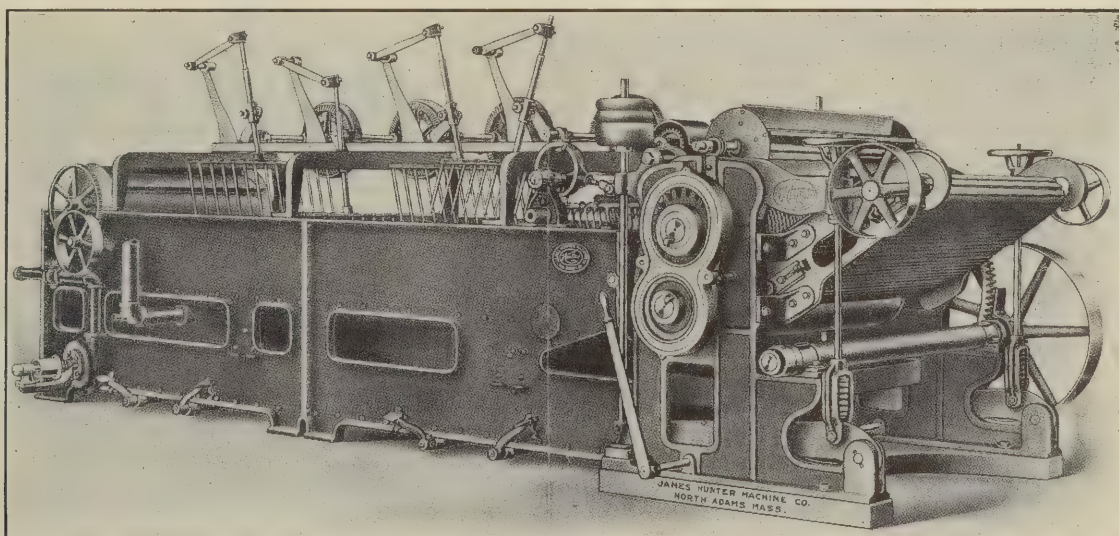


FIG. 5—Scouring Machine of Fork Type—James Hunter Machine Company

crosses the other curve at a point representing approximately 120 deg. Fahr. and 11 per cent loss of tensile

strength, this temperature being the one established by wool scourers as being best with the majority of wools.¹⁰

¹⁰ The data used in plotting the above curves is believed to be approximately correct, although not established by actual results obtained throughout their entire length. Any such curves must represent approximations, for they would vary considerably both with the grade of

wool and the nature and concentration of the scouring liquor used. Considerable work has already been done at the Lowell Textile School along these lines, and it is hoped that additional work now contemplated will establish these curves with greater accuracy.

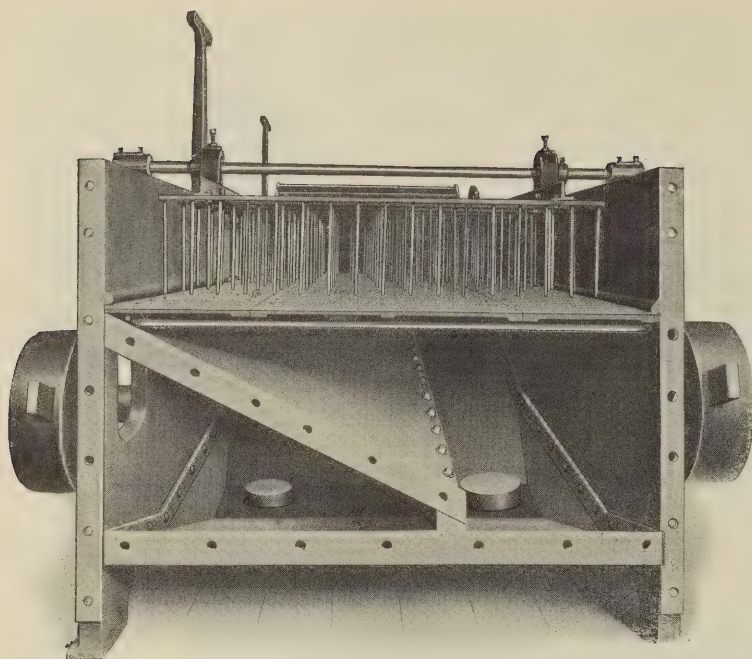


FIG. 6—Cross-Section of Scouring Bowl Shown in Fig. 4

From the foregoing discussion it will be understood that the wool scourer has two very important elements of control over the condition of the scoured wool—first, the nature and concentration of the scouring liquor, and, second, its temperature.

MACHINERY USED

Although the use of proper scouring agents and due regard to the temperature of the scouring bath are the paramount considerations in successful wool scouring, the apparatus used and its installation are largely the controlling factors of the economy of the process, and to no little extent, of the condition in which the wool is left after the process is completed.

SCOURING MACHINERY OF EARLIER DAYS

In the earlier days of the industry wooden tubs heated with live steam or steam coils were extensively used, in which the wool was worked by hand by means of wooden poles. The scouring bath was made up with the proper quantities of soap and alkali and the temperature brought to the desired point and the wool then introduced and worked until the necessary scouring action had taken place. The tub was frequently provided with a large gate which could be easily opened, and the liquor quickly run out, the wool being retained in the tub by a rather coarse screen. Sometimes fresh water was run in for several minutes as the waste liquor was running out, thus cooling the bath slowly, while in other

cases the scouring liquor was allowed to immediately and entirely drain off, and the wool then rinsed with warm fresh water, and finally with cold water.

Various types of so-called "rinse boxes" in which a cage containing the wool was lowered in and out of the scouring and rinsing liquor were also used. As time went on these hand methods were for the most part replaced by machines and to-day practically every establishment of any size uses one of the several types of continuous scouring machines.

MODERN SCOURING MACHINERY

In the modern machines the scouring and rinsing liquors are contained in long rectangular iron tanks commonly known as "bowls," and through these the wool is slowly worked by means of large "rakes" or "harrows" in some instances and by means of "forks" in others. As a rule not less than three and frequently four or even five such bowls are arranged in a tandem position, and so equipped with travelling aprons, squeeze rolls and auxiliary rakes, as to automatically carry the wool through the entire number. In this manner it is possible to feed wool in the grease at one end and deliver thoroughly scoured wool at the other. In Fig. 2 there is shown a set of three such scouring bowls in actual

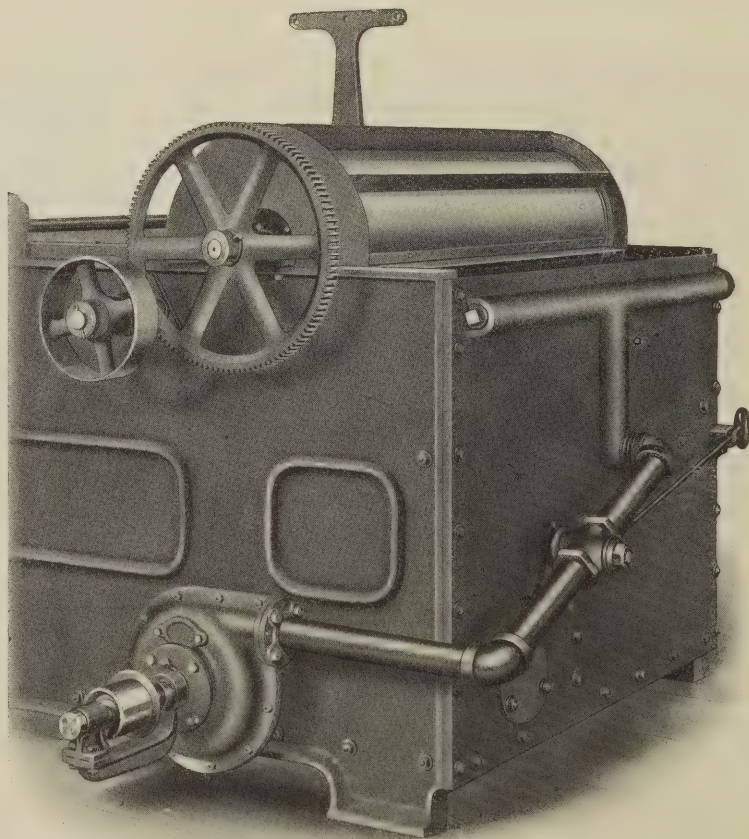


FIG. 7—Feed End of Bowl, Showing Rotary Pump and Ducker

operation. Such a set is approximately 90 feet long, 4 feet wide and will scour from 1,000 to 1,500 pounds of wool per hour, depending upon the character of the wool. A detailed view of the first bowl of the series equipped with an automatic feed is shown in Fig. 3. This machine is of the "rake" or "harrow" type, and the driving mechanism slowly and rather gently carries the wool along as it floats in the scouring liquor just above a perforated bottom located about one-third of the distance between the top and the bottom of the bowl. The bowls are built with good depth in order that a comparatively large volume of scouring liquor may be introduced, and also to provide compartments where the heavier dirt may settle out.

Another type of "rake" machine is illustrated in Fig. 4, and a "fork" machine in Fig. 5. A cross-section of the scouring bowl represented in Fig. 4 is shown in Fig. 6, the rake being seen in the washing trough just above the perforated copper bottom. The liquor which comes from the squeeze rolls passes into a settling tank of three sections which is located just beneath the main compartment of the bowl. A cross-section of one of these settling tank compartments is shown in the lower left-hand corner of Fig. 6. A centrifugal pump connected directly with the end of the settling tank pumps the clear liquor back into

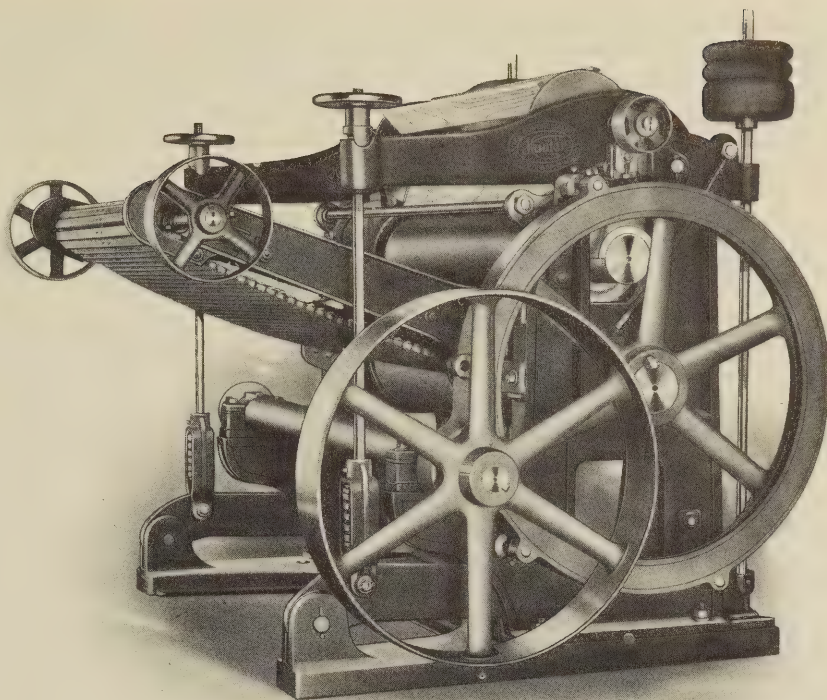


FIG. 9.—*Delivery End of Bowl, Showing Squeeze Rolls and Traveling Apron*

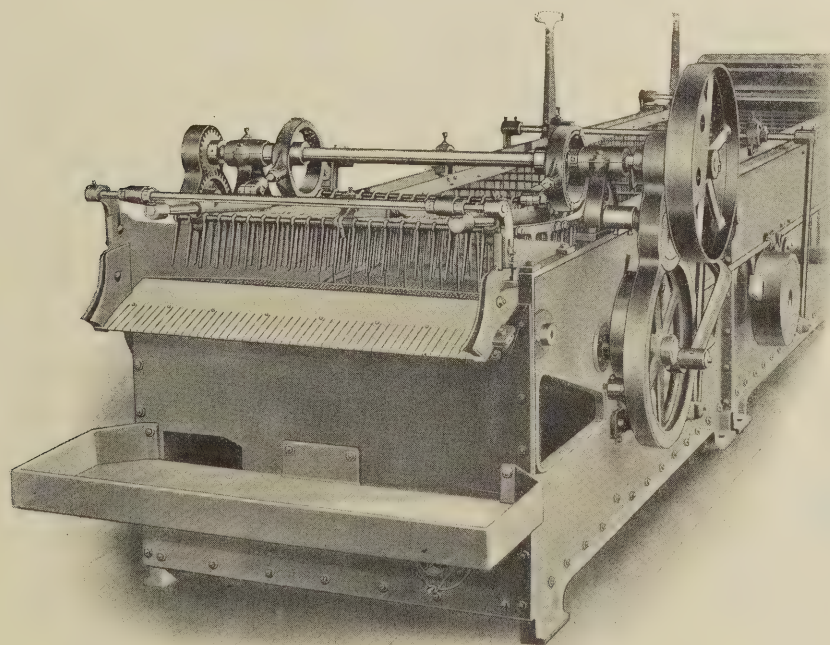


FIG. 8.—*Delivery End of Bowl, Showing Auxiliary Rake*
—James Hunter Machine Company

the upper end of the bowl where it is used over again. In Fig. 7, which illustrates the feed end of a bowl, there will be seen such a pump and its accompanying system of piping, also the "rotary ducker" which serves to immediately submerge the wool in the scouring liquor as it enters the bowl. In Fig. 3 there is illustrated an entirely different type of "ducker." It consists of two copper boxes with perforated bottoms which are attached to the rake in such a way as to push the wool down into the scouring liquor just as it enters the bowl. The wool remains submerged throughout the entire length of the machine and the rakes are so constructed and driven as to agitate the wool as little as possible and yet keep it moving in the proper direction. Upon arriving at the delivery end of the bowl, which is shown in Fig. 8, it is flushed along by means of an auxiliary rake, which carries it to the squeeze rolls illustrated in Fig. 9. After passing through the squeeze rolls a traveling apron carries the wool to the next bowl, or deposits it elsewhere if it is at the end of the series. In the series represented in Fig. 2, the wool delivered from the third bowl is dropped upon another conveyor which automatically carries it to the dryer. It is thus possible to have the whole process automatic from the entrance

of the wool into the scouring machine to its delivery in a scoured and dried condition from the dryer. Where a blower system is installed it is possible to make the proc-

ess even more automatic by bringing the wool from the storehouse to scouring machine and blowing it from the dryer to the picker room without handling.

(To be continued.)

Garment Cleansing and Spotting

An Outline of the Methods Followed in a Modern Cleansing Plant, Together with Specific Recipes for the Removal of Various Stains on Textile Fabrics

By WALTER J. BAILEY, JR.

Bayburn Cleansing Shop, Cambridge, Mass.

GARMENT cleansing is divided into nine operations, as follows: Marking, sorting, dry cleansing, steam cleansing, dyeing, spotting, assorting, pressing, and shipping. A general description of the several operations will be interesting but the spotting, which consists of removing stains from fabrics, may be found useful as well as interesting.

MARKING, TAGGING AND PRICING

Marking and tagging is a very important operation, as it is here that the garments are started on their trip through the cleansing plant either right or wrong—the latter causing much delay, dissatisfaction and expense. The marking has to be done by a girl of much experience having a general idea of the process and a great deal of common sense. It is done either by hand with pen and ink or by a marking machine, which is faster.

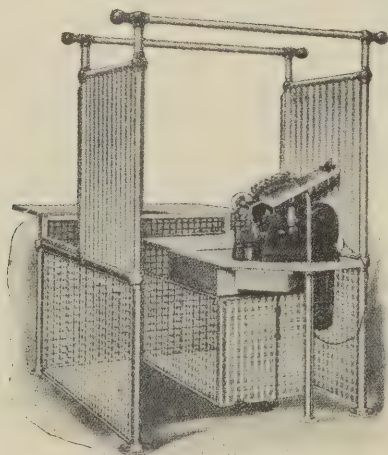
It consists in placing a numbered identification mark on the garment by means of a tag, which is either sewed or placed on by small points through the belt or under the arm of the garment, whichever

the marker finds best from the standpoint of not injuring the garment itself. These numbers are used later, and therefore must be made clearly legible with an ink which will not come off in any of the operations to which they must be subjected. This same girl must be proficient in pricing the articles so that neither the customer nor the concern will be wronged. The next step after marking is sorting and separating the different classes of garments; first, for steam cleansing, and, second, for dry cleansing.

STEAM CLEANSING

There are many articles which come to the cleansing plant to be dry cleansed, such as articles of bedding, blankets, cotton-covered comforters, fancy embroidered table covers, lace curtains, rubber raincoats, etc., which it is impossible to cleanse except with the soap-and-water process known as steam cleansing. It is often a hard task to convince a customer that these articles cannot be dry cleansed as they have ordered. The general public is allowed to continue to entertain an entirely wrong impression, and believes its twenty-five-dollar blankets are cleansed by the so-called dry cleansing process. There are exceptions in the case of blankets, but these are very few, and in this article it will be sufficient to give the generally common procedure.

Steam cleansing from the standpoint of the cleanser is more than washing as thought of by the public when they hire a woman to come in on Monday and do the family washing. It is a careful study of fabrics in combinations to remove stains and soil which cannot be removed by any other means. It is a study of how to save the colors from bleeding where there is more than one in the garments. If the manufacturer would only consider this statement when he manufactures two or more colored silk for wearing apparel he would do more to help the public, and incidentally the cleanser, out of many arguments and sometimes trouble. It would be a pleasure to think that all dress goods colors were fast to soap and water and would



Marking and Tagging Booth

Showing the marking machine. The garments are received from the back, each order taken separately. The proper identification is placed on the garment here.

be set by means of an acid bath. Steam cleansing is a study of mild bleaching in some cases and severe bleaching in others, as in the case of white flannels and white silk. Lastly, it is a study of finishing the process by sizing, and bluing in the case of white goods, brightening and dulling effects of soaps on colors, so that the articles may be carefully pressed and returned to the customer looking as lustrous and feeling as firm as any article which has been nicely dry cleansed.

Articles to be dry cleansed are separated into six different lots, as follows: White silk goods, white woolen, dark silk, gray woolens, ladies' dark blue and black woolens, serges, and men's dark colored garments. This necessitates making six different piles, which is very easily done by a special rack having six different compartments. The person doing the sorting will, of course, give very careful attention to the condition of the garments and texture of the fabrics, but in the six classes for naphtha or dry cleansing search must be made through the pockets and linings for common matches. Matches are trouble-makers in the naphtha room and oftentimes result in a fire, with a great loss of property, and sometimes even the operators barely escape with their lives.

DRY CLEANSING

The so-called dry cleansing process is also known as naphtha cleansing. It is a process of washing garments with gasoline or any dry liquid. Gasoline is the most generally used, as it is less expensive even at the present high price. It is fairly stable at ordinary temperatures, but still will evaporate at a temperature of over 125 deg. Fahr. with great rapidity. The six lots are all washed in naphtha but by different methods; for example, a very thin georgette evening gown trimmed with heavy beads must be handled alone and done practically all by hand, while

a man's heavy overcoat is put in the naphtha with twenty-five or thirty other articles of similar weight. The same style washing machine is used as that of the laundry, with exception that it is advisable to have a metal shell and rotate the cylinder very much slower.

SOAP IN DRY CLEANSING

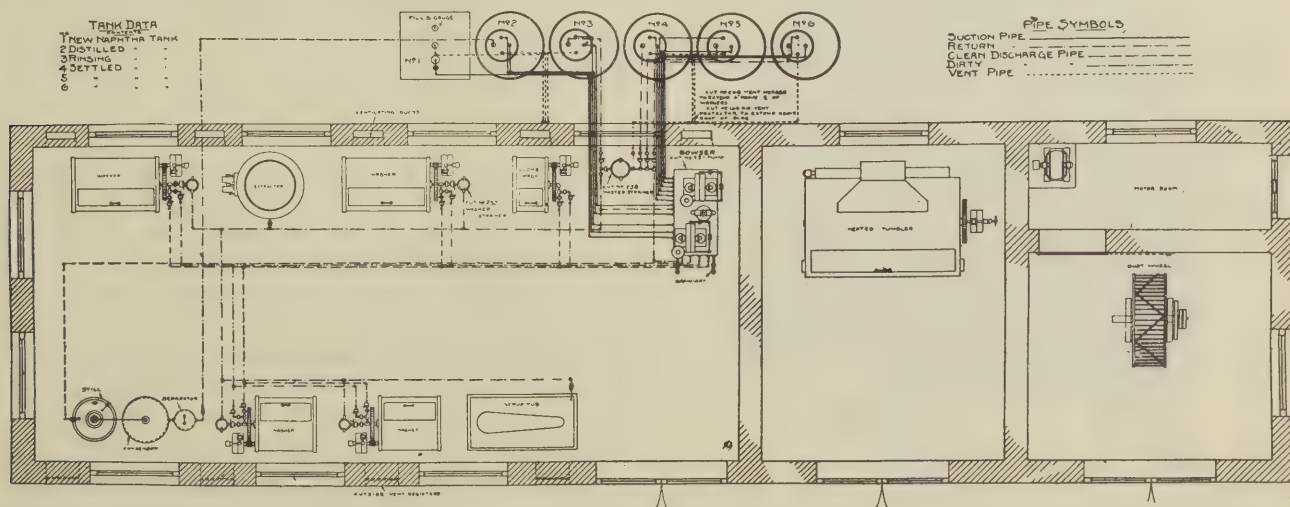
Soap is as important a factor in dry cleansing as in the family wash. There are many dry cleansing soaps on the market, but some find they obtain better results from a soap made new at the plant as they need it, with a fatty acid saponified with ammonia. This gives a very strong odor of ammonia uncomfortable for the operator, but the cleansing power is unexcelled. This soap must be freely soluble in cold naphtha, because a soap that settles on the bottom of the machine is doing nothing to aid in the cleansing and is only wasted and drawn off to be separated in the clarifying process.

RINSING

The garments, having been properly washed, must now be rinsed with clear naphtha. The white silk or woolen must have at least two perfectly clean rinses, whereas the men's dark suit lot is satisfactory with but one. This operation being complete, the garments are dried in a drying tumbler or in a hot room to remove the last trace of naphtha, even to the odor.

DRYING

The drying tumbler is a machine having action similar to the washing machine, but is so conducted that a draft of hot air is blown through the garments, exhausting out of doors. Light silks and white woolens are more satisfactorily dried by hanging with temperature in a hot room, so that there is no more friction subjected to a delicate material, thus giving further chance for injury. After drying comes the process known as spotting.



Floor Plan of a Naphtha Cleaning Plant

Showing the lay-out of the washing machines, extractor, still, pump, underground tanks for storage of gasoline, drying tumbler, motor and dust wheel

SPOTTING

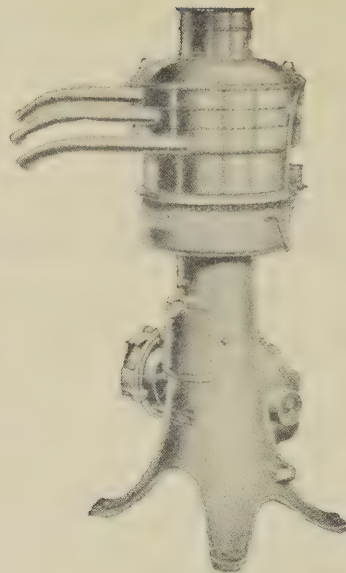
After a garment has been cleaned in naphtha it should be freed from grease and oil. In removing the oil the dirt and the dust are also removed, if the naphtha cleansing process has been efficiently done. There are other stains and substances which are often found on the fronts of coats and vests that are insoluble in naphtha—paint spots, which are found anywhere on the garments, and a hundred other spots which are not soluble in gasoline or naphtha and must be dissolved by some other medium, such as alcohol, tetrachloride of ethane, tetrachloride of carbon, ether, chloroform, acetone, etc. There are still other spots which have no trace of substance but have stained the fabrics, and must be treated sometimes with an acid, alkali, peroxide of hydrogen, potassium permanganate, sodium bisulphate, etc. To go into details more specifically, we will consider the common stains in the following order: Varnish stains, paint stains, color stains (dye), acid stains, alkali stains, coffee stains, blood stains, fruit stains, perfume stains, medicine stains, perspiration stains, rust stains, wine stains.

VARNISH STAINS

Varnish stains are oftentimes troublesome, especially on silk, as this fabric will not stand much rubbing. Varnish also leaves a color stain in some cases after the substance is removed. First treat a varnish stain with tetrachloride of ethane and scratch gently with finger-nail. After the substance has been removed, if color stain results, treat with alcohol; hot alcohol is more efficient where the color of the fabrics will stand it.

PAINT STAINS

Paint is much easier to remove than varnish; it does not leave a stain which has to be removed afterwards. In many cases of paint a mixture of tetrachloride of carbon and tetrachlorethane is used, with the aid of a



De Laval Centrifugal Benzine Clarifier

This machine revolves at 7,200 r.p.m., working on the principle of a cream separator. It has a particular advantage of washing the dirty black gasoline with water. The water and dirt run out of the lower spout. Clear gasoline from the next spout up. The top spout is an overflow, and only shows when the machine is filled with dirt, and must be cleaned.

piece of castile soap. Rub the dry piece of soap on the stain, then wet with tetrachloride mixture. In many cases of extreme hardness of the stain let it soak for a short time, as in time the paint will soften enough to work. The finger-nail or horn spatula is excellent to work the stain, and the paint will come off very easily. After the removal of the paint the garment should be brushed and naphtha used around the spot to remove the tetrachlorides. On men's dark wear it is economical to remove the paint in the naphtha room with a strong solution of naphtha soap made up in a medium of kerosene and applied in the same manner as the tetrachloride method.

COLOR OR DYE STAINS

Color stains appear on garments mostly under the arms of ladies' jackets or on skirts, especially on the white lining. Oftentimes this is from a logwood-dyed interlining, or may be any color from a waist, run by perspiration.

On the white lining it is well to rip open the seams so that the material may be pulled away from the rest of the garment, then the following procedure is started: First, take out all the color possible with a hot solution of neutral soap, dipping the stained portion in and out until all of the loose color is removed. If this does not take out the stain satisfactorily, hot alcohol is next used in the same manner as the soap solution. After both the above methods have failed,



Dry Cleansing Washer

Showing the metal shell and wooden basket best suited for general all-round naphtha cleaning

we next resort to a strong reducing agent known in this line of work as zinc bleach. This is made up of zinc dust and bisulphite of soda; boil, settle, draw off clear liquid, boil this clear liquid, and use hot in the same manner as the soap. It is very seldom this last resort is necessary.

ACID STAINS

Acid stains show up mostly on men's blue, brown and black clothes, and show a bright orange, yellow or red stain. Concentrated ammonia is most effective and is put on in full strength and allowed to remain there to dry.

ALKALI STAINS

Alkali stains are treated with acetic acid, which is sponged on and dried. In some cases dilute sulphuric acid is better, but must be followed by careful rinsing.

COFFEE, TEA AND COCOA STAINS

Coffee, tea and cocoa stains invariably contain some grease from the cream, and in many cases a slight amount of albumen. The grease must be removed **first by naphtha or carbon tetrachloride**. The stains are then sponged with lukewarm water, using a little soap if necessary to remove the albumen. In the case of cocoa this usually is sufficient, but tea and coffee have a yellow stain which is easily removed by bleaching with potassium permanganate, decolorizing the permanganate stain with sodium bisulphite solution. Rinsing must follow, leaving no trace of the chemicals in the fabrics.

BLOOD STAINS

Blood stains must be kept away from all heat until the stain has been entirely removed. It is much easier to remove this class of stains if they are fresh, for even when drying at ordinary temperature some of the substance is rendered almost insoluble in cold or lukewarm solvents. Garments with these stains should not go through the naphtha until the stain has been eliminated. First, treat with cold water, giving time enough to dissolve the albumen and other substance. Light rubbing is efficient, but must be done with much care in silks. Ammonia and soap may be used lukewarm, and in ordinary cases the stain is dissolved but sometimes leaves a slight trace of yellow on white goods. This may be bleached with permanganate of potash, followed by sodium bisulphite, with the aid of oxalic acid. Thorough rinsing must follow, and then, if free from stain, dry and proceed with the cleansing as on any article.

FRUIT STAINS

Fruit stains in many cases are weak acid stains having a residue of sugar or even orange matter. Weak ammonia aids in removing any trace of acid, and

leaves the stain in good condition for sponging with soap and water. In many cases this is all that is needed to remove the stains, but when a yellow stain is left peroxide of hydrogen will oftentimes eliminate that which remains.

PERFUME STAINS

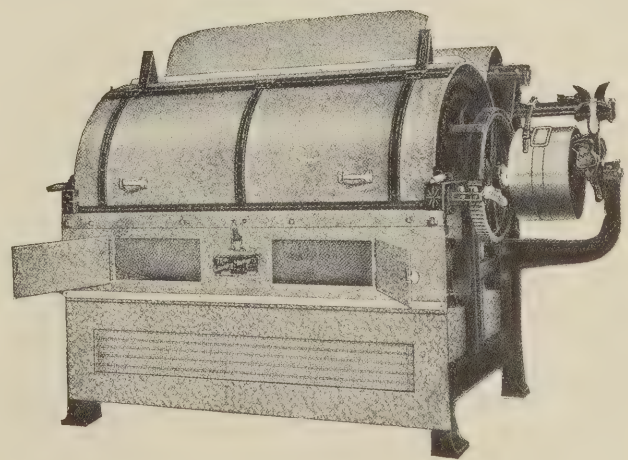
Perfumery stains are very obstinate in their removal. There is a combination of essential oils and alcohol which often affects the color of the material on which it is used. In this case there is little to be done after dissolving any oil that may be present with ether and then sponging with alcohol to pick up any ring of settled color which may be present. Sponging with soap and water oftentimes helps, but invariably a dirty yellow stain is left; peroxide of hydrogen or potassium permanganate and sodium bisulphite are all that is left to help out of this difficulty.

MEDICINE

Medicine stains are always of unknown nature, and as a rule can only be detected by the sense of smell. Warm water, with a neutral soap, is the first and most simple of all procedures. Stains that do not respond in this way are then subjected to alcohol, ether, chloroform, etc., seeking a solvent for the substance. After the substance has been dissolved we resort to oxalic acid and bleaches to remove the remaining stain. In extreme cases of obstinate spots we resort to the dangerous reagent of cyanide of potassium. This, however, is very seldom done on account of the poisonous character of this reagent.

PERSPIRATION

Perspiration is a disastrous element on garments, especially silks. It affects nearly all colors, whether on cotton, wool or silk. When the color has been



Heated Drying Tumbler

Showing the steam pipes at the bottom, where the air is drawn in and blown hot through the garments to remove the odor of gasoline.

stripped there is little to be done if acetic or dilute sulphuric acid will not restore it. White silk turns yellow, and all silks decay under the influence of perspiration. First sponge with warm water to remove any salt that may be present. Permanganate of potash is the best bleach for these stains, decolorizing the permanganate stains with bisulphite of soda and oxalic acid. Always remember to rinse well after these reagents.

RUST AND METAL STAINS

Rust stain is a very common stain on garments, especially the light summer dresses. This is easily removed by hydrochloric acid and rinsed out with warm water. There is a compound with a trade name Erusticator which comes in convenient form in tubes. This also must be rinsed carefully from the fabric.

SCORCH AND BURNS

A slight scorch, which shows yellow on white, may be helped by sponging with peroxide of hydrogen and putting in the direct sunlight for some time. If the first application is not sufficient, apply again. Col-

ored goods may be sponged with water and put in the sun, taking care not to leave in the sun long enough to fade.

In general we have covered the most common stains which are found on garments and household goods. These stains here discussed give a general idea of the procedure taken even on unknown spots. The spotter may guess that a stain is a certain thing, but with few exceptions it is merely a guess until he starts to dissolve or bleach.

SORTING

After the spotting has been completed the complete orders are brought together by means of the marks previously affixed to the garments. This makes every order complete before it leaves the spotting departments going to the press-room.

Pressing is done by men and women on their respective garments, aided by steam pressing machines and electric irons. The garments are then hung in a dry room for at least one hour to remove all trace of moisture before folding and packing. They are then delivered to the customer ready to wear, with the freshness of a new garment.

A Brief Resume of Writing and Printing Inks

Historical Review of Writing Inks—The Modern Tannin-Iron Inks—Their Chemical Nature and Process of Manufacture—Methods of Obtaining Permanency—Added Coloring Matters—Bleaching and Restoration of Writing Inks—Logwood Inks—Black and Colored Printing Inks

By WALTER E. HADLEY

WHEN it is considered that ink is universally used, wherever and whenever any records are to be preserved, it is amazing that apparently so little thought is given to the quality of the ink, and the permanency of the writings to be produced therewith.

Having occasion recently to visit the office of an ink factory, my attention was attracted to a lettered sign which had, apparently, at some time, been exhibited with the object of advertising the brilliancy and permanency of that particular brand of ink. Unfortunately, the outlines had grown exceedingly dim, and in some sections were practically obliterated, so that the sign, instead of convincing one that the ink in question was worthy of confidence, served only to emphasize the fact that the ink, lacking permanency, was practically worthless.

It is interesting to view degrees, diplomas and certificates hung on the office walls of doctors, dentists, etc., and it is really remarkable when one stops to consider the fact that very few of the signatures have been able to withstand the effect of even the few years which have intervened since they were written. Furthermore, it will be readily noted, that where several signatures have been recorded, practically no two show the same degree of permanency.

Deplorable as the aforementioned instances are, they but serve to accentuate the fact that we are lamentably negligent as to the quality of our writing fluids.

Probably the majority of people who use ink are perfectly satisfied if the ink flows freely and smoothly from the pen, and do not for a moment consider the lasting qualities of the ink.

There are many formulae, derived from different sources, for the preparation of various types of ink, special claims being advanced as to the advantages accruing from their use.

It is not the object of this paper to give formulae for the manufacture of any particular inks, such data being well provided for in such current books as Lehner's "Ink Manufacture" and Mitchell's "Inks."

The object in preparing this brief paper on ink is to awaken in the mind of the laymen more of an interest in regard to a subject of which too little is known and in regard to which too much is taken for granted.

INK CONSIDERED HISTORICALLY

Ink, considered from a historical standpoint, is extremely interesting, samples of Egyptian writing, which

are still plainly legible, having been produced as early as 2500 B. C., while it is generally conceded that other specimens of papyri date back to at least 3500 B. C.

The ink used by the earliest writers undoubtedly consisted of a carbon base prepared either by burning wood or animal matter, after which same was ground to a fine powder and properly combined with oils and gums, and probably oftentimes thinned with water to the proper consistency for writing.

"India ink" was invented by the Chinese about 1200 B. C. and was prepared by mixing a very fine soot with a gelatine prepared from asses' skin.

The greater number of documents which have come down to us from the medieval times were written with "India ink." Owing to the permanent character of writings made with "India ink" there is still a very strong tendency to use this type of ink in many modern documents. While "India ink" has no tendency to disintegrate with time, it can be obliterated if treated with water.

Tannin-iron inks were introduced into Europe from Arabia during the early part of the twelfth century.

WRITING MATERIALS

Papyrus, vellum and parchment were the earliest forms of material upon which ink writing was practised.

Papyrus was largely used by the early Egyptians and many perfectly preserved specimens have been found in the pyramids of the Pharaohs. Papyrus was prepared from a form of reed which grew luxuriantly on the banks of the Nile.

Vellum was prepared by the proper treatment of the skin of calves, while parchment was prepared from the skin of the sheep.

The materials used for applying the ink to the paper consisted at first of reeds and brushes, and later the stylus pen. During the sixth century the quill pen came into existence and its use was continued for centuries.

Steel pens first came into regular use in 1803, and ever since that time the makers of the steel pen have been endeavoring to duplicate the desirable qualities of the quill pen.

TANNIN-IRON INKS

The tannin-iron inks are now conceded to be the best and most permanent inks which can be produced, but care is necessary in the compounding of same, otherwise inks produced with these ingredients may entirely disappear from the paper.

Formerly the tanno-gallate of iron inks were prepared by treating the galls with boiling water, but it is now considered that a far better extract is obtained by allowing the extraction to take place in the cold.

The compound containing the tannin is allowed to ferment for about two weeks, when a mixture of gallic and tannic acids will exist in the solution.

In tannin-iron inks there is always more or less of the gallic and tannic acids combined with the iron in the insoluble ferric condition, and this is the portion of the

ink which imparts the immediate color and which requires the presence of gum to hold same in suspension. The gallic and tannic acids, in combination with iron in the ferrous condition, are soluble and do not require any gum. The first mentioned condition, where the compound is in the ferric state and fully oxidized, does not penetrate the paper and therefore is not permanent. The second condition, that of the compound in the ferrous state, allows the soluble ink substance to penetrate the paper, and thereafter, upon oxidation, is permanently fixed upon and within the paper.

Chinese galls are not as suitable for ink making as are the Aleppo galls, inasmuch as the latter contain a ferment which readily transforms a portion of the tannin in gallic acid. In making use of Chinese galls, it is necessary to introduce a ferment, oftentimes in the form of yeast.

Ferrous sulphate, or copperas, FeSO_4 , as clear green crystals, represents the best iron salt for the preparation of the tanno-gallate of iron inks. The use of this substance allows the iron to exist in the ink in the form of ferrous salts, and upon application to the paper they oxidize to the ferric condition and produce a permanent black.

Inks when first applied are in the liquid condition. If the ink used is a gall-iron composition, a chemical change very soon begins to take place whereby a darkening of the ink is noted and within a few days a deep black color will have been attained, assuming that the ink was properly prepared. This darkening is principally due to the absorption of oxygen from the air. Other conditions bring about the changes occurring in the ink, after its application to paper, the composition and purity of the paper, as well as the gums, acids and added color, all exerting more or less influence.

Gall-tannate of iron inks are prone to settle out from solution, and it is customary to add a gum in order to hold the particles in suspension, a vegetable gum known as acacia being largely employed. In addition to holding the particles in suspension, the gum thickens the ink, thus causing it to flow more evenly and smoothly, and further the gum serves to cover the ink, after application to the paper, and arrests any later tendency for an undue absorption of oxygen.

It has been observed that old writings, which still continue to possess a deep black color, and are glossy in appearance, do not respond to tests for gums of vegetable origin. Invariably such writings are found to owe their permanent character and brilliancy to the presence of isinglass, which was used as a medium for holding the ink particles in suspension, the coating furnished by the isinglass having protected the ink substance from over-oxidation.

ACTION OF FREE ACID IN INK

The addition of free sulphuric acid to any ink has for its object the holding of the iron salt, in solution, in the ferrous condition. It increases the limpidity, and causes
(Continued on page 24.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY

PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL

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FOOD FOR GERMAN PROPAGANDA

IT has been established beyond the possibility of successful contradiction that the one means capable of furnishing adequate protection for the American dye industry and preserving it intact as one of the hard-won fruits of an expensive and deadly war, is the licensing system proposed in the present Dye bill, which may be observed in full operation in England for the next decade. It is unnecessary to rehearse all its good points here, but the time has come for another reminder to those who are still a trifle shaky in their opinions on this all-important subject, to the effect that the proposed law is designed quite as much for the protection of dye consumers as it is for safeguarding the interests of the dye makers. Too often is this fact lost sight of by those who are prone to jump hastily to conclusions without a full knowledge of the projected statute and its workings.

The Dye bill is based on the premise that the textile and other dye-consuming industries, and the dye-making industry, must work hand-in-hand; that the interests of one are, in the long run, identical with the interests of the other. It was designed with a full understanding of the fact that disgruntled dye users, hampered in their plans for capturing their share of world trade, could in time bring the dye manufacturers to almost as certain ruin as could the competitive methods of an unrestricted Cartel. Its fundamental purpose is not solely the exclusion of foreign dyes, as some will say whenever the chance presents itself, but instead to aid at all times in maintaining a steady supply of whatever dyes American consumers may need, no matter whence they must be brought, while the building of the American industry continues, automatically shutting off the importation of certain colors only when these become available here in such form as

to satisfy the consumer in every respect. The virtues of the measure are positive, not merely negative.

It is important to keep this fact constantly in mind whenever discussions of the Dye bill arise.

During the past year much blame has been laid at the door of the American dyer for his undeniable tendency to profiteer by using wholly improper colors for the class of work on hand in place of the proper colors, readily obtainable from American manufacturers—and then shifting the responsibility for the resulting fiasco to the shoulders of the American dye manufacturers! This sort of thing has been accomplished very readily because of the still prevalent German propaganda about American dyes, which has made the public extremely quick to condemn the latter even on suspicion. Happily, however, the past few months have witnessed a distinct alteration in this outlook; a few textile manufacturers, tiring of making “excuses,” and discovering, it is likely, that these excuses were not swallowed so willingly by their foreign customers, saw the fallacy and the positive danger of the practice and forthwith eliminated it, until to-day, thanks to their pioneer work, the standards expected by the ultimate consumer are much higher and the balance of the trade is finding itself obliged to follow in their wake or be content with less business. Likewise, if the American manufacturer is to compete in the markets of the world he is forced to bring the quality of his manufactured article up to or higher than the level maintained by his foreign competitor—which to-day means pre-war standards.

In an ever increasing number of instances this standard can be obtained with American dyes, but since we are still weak on vat colors as compared with Germany it follows that in many other instances only the imported colors will enable the American textile producer to compete abroad, and if he cannot get these colors when he wants them he is being unnecessarily and wrongfully hampered.

It has come to the attention of The REPORTER that there has lately been additional dissatisfaction with the War Trade Board, at present in charge of the granting of licenses, over the question of obtaining dyes not available in this country. Such complaints have not been wanting in the past, but it had been the hope of this journal that the cause of them would have wholly disappeared by this time. Only recently, however, there arose a case where an American dyestuff dealer received an order from a customer for Patent Blue and, not being able to find it manufactured in this country, applied to the board for a license to import the necessary quantity. This was refused and the dealer referred by the War Trade Board to an American manufacturer who offered a Navy Blue which proved to be a mixture of Acid Black and Acid Violet. In a second instance an order for Rhodamine 6G was referred to a manufacturer unable to produce this color at all. Other recent examples could be cited.

It is understood that the War Trade Board, on being assured that the colors in question are unobtainable, will proceed to grant immediate permission for their importation—but in the meantime the customer has been subjected to a delay not at all conducive to pleasant thoughts about the licensing system, nor calculated to help his chances of doing business with the goods which he intended dyeing.

Such a delay is unfair to the dye user and unfair to the American dye industry, for it directly injures the interests of both. Moreover, it is unnecessary, for the War Trade Board has had ample time to verify the accuracy of claims submitted by dye manufacturers. The manufacturers in question, who professed to be able to supply these colors, are likewise at fault and should realize that they do themselves far more harm than good by creating dissatisfaction with a system upon which they must depend for their existence when Congress declares peace with Germany.

Because of the fact that greater interests are at stake than the welfare of this particular dye dealer or his customer, or than those of both manufacturing and consuming industries put together, it is the duty of the War Trade Board to possess itself of such complete information that it can determine instantly and accurately whether a license should be granted in any case which may arise, and in the event of a refusal, be able to accompany the ruling with the names of all American concerns which can supply—not merely “talk”—the color wanted.

Wherever the responsibility lies, the trouble can be eliminated and *must* be eliminated. No plea that an honest mistake was made—which was undoubtedly the case—can soften the concrete fact that some man's business was unnecessarily harassed through inefficiency in the administration of the licensing system, which is one of the simplest and most easily administered systems ever devised. Better, even, to risk bringing into the country, for once, a dye already made by an American manufacturer, than that pro-German agents here should be furnished, gratis, with ammunition of that kind. The filling of a single order by Germany which could have been filled here will not destroy the American dye industry, but many repetitions of the other form of error, will. It gives the Washington lobbyists a chance, for once, to say “I told you so”; it puts into their hands the only real weapon they can ever hope to have among the artificial technicalities which they were obliged to invoke all through the Sixty-sixth Congress.

We trust that in future the War Trade Board will err on the other side, if err it must, and meanwhile respectfully submit to the trade that the Tariff Commission, with its special study and dearly-bought knowledge, will prove a better body for the administration of the law—and that it had better be put to work right away by the enactment of the Dye bill.

SUPPORT THE A. C. S. DYE DIVISION

WITH the spring meeting of the American Chemical Society but three weeks off, The REPORTER desires to add its plea to that of the heads of the organization that there be as large an attendance as possible. Particularly upon our dye manufacturing readers do we urge this. The meeting will be held with the Rochester Section of the Society from Tuesday, April 26, to Friday, April 29, inclusive. Reduced railroad rates have been secured for the benefit of members. It is announced that all divisions except the Division of Fertilizer Chemistry will meet, and each division and section will have two full days at its disposal. The Division of Dye Chemistry, therefore, will not only be an active part of the meeting but should have ample time to do a service to the industry.

Secretary R. Norris Shreve, of the Dye Division, who can be reached at 43 Fifth Avenue, New York City, announces an interesting program. There ought to be enough in the statement that Representative Nicholas Longworth, father of the Dye bill, will speak, to insure a full attendance of dye men on this account alone. Mr. Longworth, we are told, will speak on the first regular day of the meeting, April 26. Secretary Shreve adds that as the dye industry is in a critical stage at present and is liable to be for some time, it behooves everyone connected with this industry to participate in the meeting for the mutual benefit of themselves and the industry.

We do not wish to omit mention of the fact that all those intending to present papers which have a popular appeal should send synopses of them as early as possible to the technical manager, A. C. S. News Service, 1 Madison Avenue, New York City. Synopses may be from 300 to 500 words in length and should be in as non-technical language as is consistent with accuracy and precision. It is the intention of the A. C. S. Service to forward all material of this kind to the press as nearly ten days in advance of the release date as possible, and in co-operating, authors will facilitate the work of the service and help to foster public interest in chemistry, making the work of the chemist better understood and appreciated. Dye chemists do not need to be told what publicity at this time will mean to the industry. In case you are unable to send in your synopsis before April 22 it may be forwarded to the technical manager of the service at the Hotel Rochester, where a press room will be maintained.

Any further details may be obtained from Mr. Shreve. This publication urges all dye chemists not already members of the society to apply at once for membership. The society is performing a wonderful work for the cause of chemistry in this country, and you are not doing your duty as a 100 per cent useful representative of your profession while you remain a social hermit. Plan to secure your membership without delay and, if possible, to attend the meeting. But at least you can support the work of the society by becoming a member.

A BRIEF RESUME OF WRITING AND PRINTING INKS

(Continued from page 21.)

the ink to penetrate into the paper by which means the ink surrounds the fibers of the paper and becomes firmly fixed. The addition of too much acid is dangerous, as an excess would eventually destroy the paper.

Because a steel pen is badly corroded by any particular ink does not of necessity condemn the ink, as this very quality is an indication that the ink would penetrate and be fixed upon and within the paper, and thus produce permanent writing. Regarding the action of acid upon pens, some hold to the belief that the acid at first attacks the pen, but that the presence of the gum thereafter protects the nib and further corrosion does not occur.

A certain ink company, using a minimum amount of acid in their inks, after having had numerous complaints regarding what was referred to as corrosion of the steel pens, increased the amount of free sulphuric acid and the complaints immediately ceased. What had been referred to as corrosion was, in reality, due to gumming of the ink, the lack of acid having induced the thickening of the ink.

Some manufacturers believe that acetic or hydrochloric acid is preferable to sulphuric acid, due to the fact that the two former acids are volatile, while the latter is non-volatile and remains upon and within the paper. It is an accepted fact, however, that some form of free acid is necessary in an ink.

PRESERVATIVES OF INK

It was early noted that gall-iron inks exhibited a decided tendency to develop mould, and for a long time this condition was accepted as unavoidable. Ferrous sulphate, in excess of what was necessary to combine with the tannin, was formed to exert a preservative action. The presence of this excess of ferrous sulphate, however, caused the writings produced therewith to quickly change to a brown color.

With the introduction of preservatives other than ferrous sulphate (green vitriol) it has been possible to reduce the amount of ferrous sulphate in many instances.

Other and better preservatives gradually came into use, such as carbolic acid, one pound of which will perfectly preserve 1,000 gallons of ink.

Salicylic acid, borax and alum have also been used, the two former ones quite successfully. The use of alum is not desirable, inasmuch as it affects steel pens, and unless an excess of acid is present in the ink, the alum would have a tendency to cause a deposition of the coloring matter.

THE COLOR OF TANNIN-IRON INKS

Tanno-gallate of iron inks are prepared with or without added color, although those containing added color constitute by far the greater percentage.

The disadvantage in the use of tanno-gallate inks, con-

taining no added color, lies in the fact that they do not produce a pleasing appearance when first applied. Such inks, if properly prepared, do however develop an excellent black within a few days after their application. The danger attendant upon the use of ordinary gall-iron inks, containing added color, is that improperly prepared inks could present a very beautiful appearance, when first applied, but would be utterly lacking in the time-resistant qualities which are of prime importance for any ink.

THE USE OF ADDED COLOR

The adding of color to a gall-iron ink is for the purpose of rendering the original writing more pleasing to the eye and is not carried out with the object of increasing the durability of the ink.

Such substances as madder and logwood, while added to inks to impart color, tend to mitigate against the permanency of tanno-gallate of iron inks.

Indigo, in the form of Sulphonated Indigo, has been used as an added color, with eminently satisfactory results, and does not affect the durability of the ink.

Certain of the acid blues and direct cotton blues are suitable for use as added color. The basic blues are unsuited due to the fact that they precipitate in the presence of tannin compounds. Colors must be used which are not affected by sulphuric acid.

Certain dyes have been recommended as suitable for ink making, both for production of black as well as colored inks, such compounds being nothing more nor less than solutions of dyestuff together with gum for thickening. Such dyes as Naphthalene Green V. Conc., Nigrosines, Cyanoles, Patent Blues, Acid Greens, etc., are said to be suited for production of such ink, as well as for use as "added color" in shading gall-iron inks.

CHEMISTRY OF TANNIN-IRON INKS

The tannin compounds used in ink manufacture are derived from vegetable compounds such as Aleppo and Chinese galls, sumac, divi-divi, myrobalans, oak bark, etc.

Those tannin compounds which contain three hydroxyl groups in juxtaposition produce a blue black coloration in combination with iron salts, and this is the only type suited for ink manufacture.

Gallic acid [$C_6H_2(OH)_3COOH$], Haematoxyline [$C_{17}H_2(OH)_3 \cdot C_6H_4 \cdot C_6H_2(OH)_3$] and Gallotannic Acid [$C_6H_2(OH)_3CO.O.C_6H_2(OH)_2COOH$] are each excellent examples of the foregoing.

Blotting makes ink much more liable to fade. A good grade of blotting paper will remove, from a hard finish paper, about two-thirds of the amount of freshly applied ink. Such a treatment does not leave enough ink to penetrate between the fibers of the paper and the writing at best is more or less superficial.

The old type of tannin-iron inks, which immediately produced a black upon writing, were made by allowing the ink to remain exposed to the air, whereby a certain amount of oxidation took place, and the immediate black writing was due to the provisional color thus obtained.

This oxidized color did not penetrate into the fibers of the paper, but was only held on the surface due to the binding effect of the gum. The unoxidized portion of the ink penetrated the paper and there oxidized, thus producing a permanent black ink, whereas the upper portion could be easily removed by water.

A tanno-galate of iron ink which has been exposed to the air, and has evaporated, should never be diluted with water, because the particles of ink which have been injured will never again assume their original condition, the soluble ferrous gallate and tannate having been oxidized to the insoluble ferric condition.

REQUIREMENTS OF A GOOD BLACK INK

To represent the best value, a black writing ink should possess the following characteristics:

It should be of such consistency that it will flow smoothly from the pen. It should be able to enter into the paper to such a depth that the subsequent oxidation will thoroughly fasten the particles upon and within the paper. It should not mould or thicken in the ink well. Writings produced therewith should dry quickly. Furthermore an ink to be desirable should produce writings which are proof against time.

BLEACHING OF INK AND RESTORATION OF SAME

When gall-iron inks are subjected to the action of certain chemicals, the color is apparently destroyed although in reality it may simply assume a form which is colorless and a subsequent chemical treatment may render the ink visible again.

This condition is one which even a clever forger is not always able to guard against. It may be that a forger will feel that an ink has been absolutely obliterated from a document which he wishes to alter, while as a matter of fact the base of the original ink may still be present, and upon further chemical treatment be rendered perfectly legible.

Sodium hypochlorite is used as the basis of ink eradicators, the ink first being treated with a weak acetic or tartaric acid solution and thereafter with sodium hypochlorite. Oxalic acid and sodium bisulphite as well as peroxide of hydrogen are also used, but remove the ink more slowly.

Gall-iron inks, which have been treated by the foregoing methods, may be rendered legible by allowing same to come in contact with the fumes of ammonium sulphide, by which means the iron base of the ink will be blackened due to the formation of iron sulphide. In certain cases the legibility may be restored by treatment with tannic acid when, if iron is still present, a black color will be produced due to the formation of tannate of iron. Further, if iron is present, a treatment with yellow prussiate of potassium, in the presence of acid, will yield a blue coloration.

The fading of iron-gall inks is largely due to the over-oxidation of the ink by means of which tanno-gallate of

iron precipitates in the ink and when this ink is applied to paper there is an insufficient quantity of the active principle to give the required body to produce a permanent record.

According to "G. Martin" a gallo-tannate of iron ink which is said to yield good results may be prepared as follows:

42 ozs. extract of Aleppo galls in
120 ozs. water

Allow to ferment for ten to fourteen days. Add

2 ozs. Indigo Carmine, or other suitable blue dye.
5½ ozs. Ferrous Sulphate
2 ozs. iron previously dissolved in commercial acetic acid
Phenol may be added to preserve the ink.

According to "Whittaker," an ink, accepted as standard, is prepared as follows:

Dry pure tannic acid.....	23.4
Crystallized gallic acid	7.7
Ferrous sulphate	30.0
Gum arabic	10.0
Hydrochloric acid	2.5
Carbolic acid	1.0

Make up to 1,000 with water, adding sufficient soluble blue to make the first writing visible.

Powdered ink is now on the market and is prepared by carefully compounding the necessary proportions of tannin, sulphate of iron, and dyestuff, with a small amount of salicylic acid which acts as a preservative. These ink powders are held in small containers and when required are mixed with a definite volume of water.

LOGWOOD INKS

Logwood inks are among the cheapest and easiest inks to prepare, and may be produced by the proper combination of a logwood (rich in haematoxylin) and iron salts, such an ink writing a greenish shade which assumes a black color within a short time. Logwood inks produced with alum show a violet-black color while logwood inks produced with chromium show a violet writing which rapidly changes to a black. Logwood inks have found wide application for use in schools, where, for much of the work, a really permanent ink is not required.

In case chromium compounds are to be employed, it is better to use the sodium compounds which are far more soluble than the potassium compounds. Furthermore potassium precipitates haematin from the solution, whereas sodium does not. Care should be taken that a proper amount of preservative be added to a logwood ink, as they are prone to thicken. This thickening has been, in some instances, ascribed to bacterial action due to the presence of excessive amounts of nitrogenous

matter in the logwood used in preparing the ink.

In logwood inks, where alum is used, there is grave probability that the coloring mater will be precipitated out as an aluminum lake with the subsequent weakening of the ink.

THE USE OF COLORED INKS

During recent years the preparation of colored inks has been rendered extremely simple, due to the great variety of coal tar dyestuffs available. The durability of the inks is, of course, dependent solely upon the durability of the colors used.

The Eosines, appearing under different trade names, are the dyes principally employed for the preparation of the red inks. Cochineal, Madder, Saffron and Brazil Wood were formerly used for the preparation of red inks.

The other colored inks are made from the basic type of colors consisting of blues, violets, greens, etc., dissolved in the required amount of water, and thickened with gum arabic. As a general rule, the colored inks need no preservative, the dyestuff itself acting in that capacity.

(To be concluded.)

Technology of Chrome-Tanned Upper Leather—Part IV—Coloring and Finishing

Classification of the Various Coloring Materials Used on Chrome Leather—Showing How They May Be Best Applied. Outline and Suggestions on Finishing

By WILLIAM C. JACKSON

Colorist with J. S. Barnet & Sons, Inc., Lynn, Mass.

DOUBTLESS the department in which the processes used are the least understood by the average leather manufacturer is the coloring department. The ability to produce uniformity, clearness and the various shades as they come out is an art, learned only by long experience and a thorough knowledge of the dyestuffs and materials used. A good dyer can easily save his salary by his careful selection of dyes and processes, obtaining at the same time the desired results.

The field of leather coloring as compared with that of textile coloring is limited, due mainly to the fact that the dyeing cannot be carried on at a boiling temperature. The coloring matters used may be classified as follows:

1. Vegetable Coloring Matters.
2. Artificial Dyestuffs.
 - (a) Direct or Cotton Dyes.
 - (b) Developed Dyes.
 - (c) Acid Dyes.
 - (d) Basic Dyes.

VEGETABLE COLORS

Among the vegetable coloring matters used on chrome-tanned leather are sumac, gambier, cutch, quebracho and fustic, all of which are rich in tannin and of an astringent nature. When used with salts of

iron they produce tannate of iron and yield grays of varying intensity; with potassium titanium oxalate various tones of yellow are produced; while with bichromate of soda a brownish cast is obtained.

Their chief uses are as a vegetable retan to plump the stock and as a mordant for basic colors and should never be applied at a temperature of over 90 deg. Fahr. to avoid "piping" the grain. They are all very fugitive to light and fatliquor and lack fullness. Hypernic contains a red coloring matter and is produced from Nicaragua or peachwood and is closely allied to logwood, which formerly was extensively used for producing blacks but which now has been largely superseded by direct black.

SYNTHETIC DYESTUFFS

We will take up that branch of leather coloring covered by the artificial or synthetic dyestuffs. Before the war all these dyes came from abroad and each firm had its own names for its products. Many of these colors were chemically identical but had different standards of strength. Competition was so keen that in order to introduce his products, a salesman would cut his price and make it up with salt or dextrine or shade with a little blue to give the appearance of fullness, thereby making many different names or marks for the same dyestuff.

It was the writer's good fortune to have been in the employ of the National Aniline & Chemical Company,

Inc., during the period when it was building up its business and he had many opportunities for testing out these American-made products against the old pre-war German colors. He can truthfully say that in no instance did the German products excel;—in fact, in many cases, the American colors were superior in hue (purity of color), strength and fastness.

To accomplish in four years what it took Germany forty has been a stupendous proposition, nevertheless it has been accomplished by the aid of science and American energy—therefore let us give our American dyestuff industries all the encouragement we can, as it is only through their increased volume of business that we shall be able to obtain lower prices on their products. Buy your dyes direct from the manufacturer and limit your list of colors to the smallest number possible.

Theoretically, any color may be produced by the proper combination of the three primary colors: Red, yellow and blue but, practically, it will not work out thus, on account of the difference in affinity which certain dyes have for leather, also the action of the various materials used on the stock is different towards the various dyestuffs, and again no dyestuff is pure in hue: that is, identical with its spectrum standard. There is always present a secondary color or cast as, for example, Xylidene Scarlet is a red with a yellow cast and Azo Rubine Extra is a red with a bluish cast.

We will now take up the various classes of dyestuffs explaining the particular field to which each is best adapted, together with those dyes which give the best results on chrome-tanned leather.

DIRECT COLORS

Direct or cotton dyes (salt colors) are as a rule azo compounds derived from benzidine or from bases which are similar to benzidine in their constitution. They are best applied direct to the neutral stock. They have little affinity for tannin, consequently cannot be used on a vegetable bottom. They are very soluble in alkalies and are therefore easily stripped by fatliquors. Many are sensitive to various reagents and will not hold up well on glazed leathers. They produce very brilliant colors and exhaust well and are frequently dyed in a salt bath. Erie Congo 4B; Erie Yellow F; Niagara Blue 2B and Erie Black GXOO are about the best representatives of this class.

DEVELOPED COLORS

Many of these direct dyes contain a free amido group, which is capable of further diazotization. When this is the case, the dyed stock may be further treated with nitrous acid, which converts the amido group into the diazo group and when treated with any naphthol or amine forms a very fast and full color. This method is used extensively in making Black Ooze calf, which may then be topped with a basic black. Among the dyes

used in this method are Diazine Black H Extra and Erie Green M. T.

ACID COLORS

Acid dyestuffs are the sodium salts of the sulphonic acids as well as of such dyes as certain phenol groups associated with nitro groups. They will affix themselves directly on the fiber but will exhaust better and produce fuller colors if the dyebath is slightly acidulated with sulphuric acid. They will dye both chrome and vegetable tanned leather but tannin acts as a retard and consequently if the chrome stock is previously treated with a tannin compound, the dyeing will be more level but not as full nor as brilliant. Acid colors will precipitate basic colors and are therefore frequently topped with basic dyes, thereby producing very fast and full shades. The best acid color to use as a bottom for the prevailing brown shades of upper leather is Resorcin Brown R on a vegetable bottom and top with the proper combination of the following basic colors:

Bismarck Brown R,
Safranine A,
Victoria Green WB,
Auramine O.

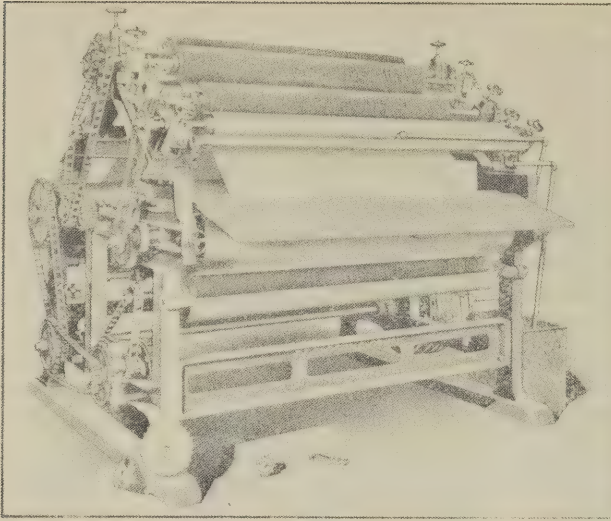
For the Cordovan or Tony Red shade, substitute part of the Resorcin Brown R with Fast Red S. Conc. and replace the Auramine O in the top color with Methyl Violet.

Among other acid colors used extensively on leather are Metanil Yellow, Orange A, Buffalo Black N. B. R. and the Nigrosines.

BASIC COLORS

Basic dyes are salts, usually hydrochlorides but sometimes sulphates or oxalates of dye bases. They are not substantive to chrome leather and must be applied on a tannin mordant, which has been fixed with potassium titanium oxalate, bichromate of soda or tartar emetic. Basic dyes produce very full shades and are fairly fast to fatliquor, especially when fixed with titanium or chrome, although Chrysoidine is very fugitive in this respect. Basic colors have a tendency to bronze, especially Fuchsine and Methyl Violet and should be used sparingly. Before the war phosphines were very popular on account of their fastness and level dyeing properties but with the advent of the pigment finishes, they have been largely replaced, on account of price, by mixtures of Bismarck Brown R, Safranine A, Victoria Green W. B. and Auramine O which will produce almost any tone of brown or red.

Care should be taken to thoroughly wash stock colored with basic dyes previous to the fatliquoring to free the stock of any liberated acid which would form fatty acids with the fatliquor and produce greasy spots on the finished leather.



*Crown Band Seasoning Machine
F. F. Slocumb Co., Inc.*

After fatliquoring the stock should be thrown into a tub of lukewarm water and then horsed up grain to grain and allowed to stand over night and then set out, shanked and sent to the dryer or hung on hooks in a hot room until dry. It should then be piled down in a cold room for ten days and allowed to mellow before sending to the finishing department.

FINISHING

With finishing as with coloring it is a waste of time and space to attempt to lay out any definite procedures on account of the ever changing demands of the trade. Furthermore, a process that would work out well in one factory would not produce the desired results in another. Therefore a general outline with a few helpful suggestions is deemed more expedient.

The stock from the dryer is in a hard and more or less wrinkled condition and is said to be "in the crust." The method employed to soften and open up the fibers and make the leather supple is to put it into damp sawdust where it will absorb the moisture and be in a suitable condition for staking, which consists in holding the skin between a set of reciprocating jaws and working it around until all the fibers have been loosened.

In preparing the sawdust care should be taken not to have it too wet. A very good way to test it is to squeeze a handful, and upon releasing it the moisture should just be perceptible in the palm of the hand. Put the stock in, two skins at a time, grain to grain, cover well, and so on until all are in. Stamp down well, leave over night and next morning stock should be ready for staking. Too much stress cannot be laid on the condition of the dust, for if too wet the stock will wet through on the flanks and stain and will be hard off the tacking frames. After the stock is staked it will be helped by knee-staking the shanks and then

tacking on frames, keeping the temperature of the tacking room between 90 and 100 deg. Fahr. When dry, pull off and a much better "break" may be obtained by putting back into nearly dry sawdust for a couple of hours and then restaking on a clamp staking machine. The leather should now be brushed, trimmed and sorted into the various grades, weights and finishes.

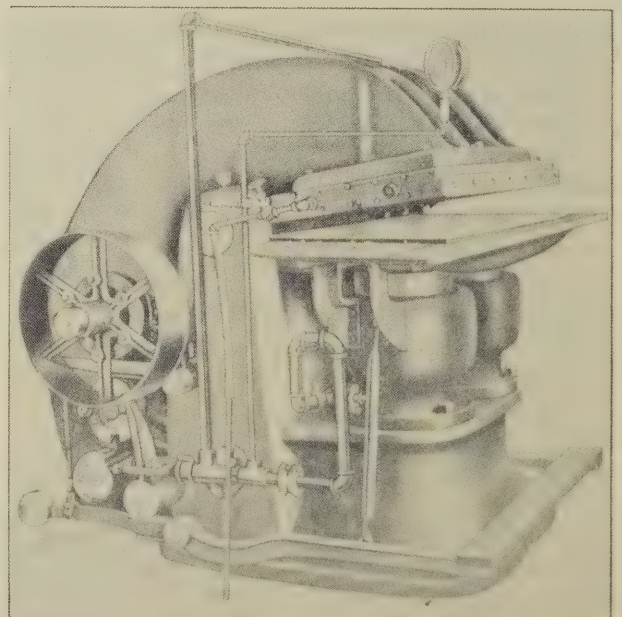
For a bright finish it is generally necessary to put on two coats of pigment by machine and when thoroughly dry, glaze and then give a top coat by machine and glaze again. This is followed by a final top coat put on by hand and plate when thoroughly dry. Calfskins give better results by being plated on a Turner hydraulic press but side leather comes out better on a Sheridan press.

For a semi bright finish one glazing is sufficient and that should be after the first top coat. An ironing by hand is often beneficial and should be the last operation before sending the stock to the measuring machine.

Pigment finishes, of which there are many on the market, are composed of earth pigments held in suspension by pastes made up of such materials as Carnauba wax, soap, casein, shellac, Irish moss and flaxseed. These finishes are diluted to the proper consistency and toned with aniline dyes to obtain the desired color.

We have followed the process of making leather through the several departments and, to convert the raw stock with its various imperfections into a uniform piece of leather, which will pass the critical inspection of the leather buyer, is no mean task and requires eternal vigilance on the part of the manufacturer.

(Concluded.)



*Large Hydraulic Press, Open
Turner Tanning Machinery Co.*

MEN OF MARK in the DYESTUFF FIELD

Walter S. Williams
Chemical Engineer

Mt. Hope Finishing Co.
North Dighton, Mass.



WALTER S. WILLIAMS was born December 12, 1872, at Haverhill, Mass., and received his early education in the schools of that town and of Nashua, N. H. He graduated from the Massachusetts Institute of Technology in 1895, receiving the degree of chemical engineer, and subsequently remained thereat for one year as instructor in industrial chemistry and textile coloring.

Mr. Williams' first industrial position was as assistant superintendent of the H. N. Slater Cambric Works, at Webster, Mass. After three years in this position he became chemist of the Arnold Print Works, at North Adams, Mass., which position he occupied for eleven years, during the latter part of his time assuming the added duties of purchasing agent.

Upon leaving the Arnold Print Works Mr. Williams practised for some time as consulting chemist and engineer for textile mills, being associated for awhile with Arthur D. Little, Inc., of Boston. In 1914 he became chief chemist for the U. S. Finishing Company, in which capacity, during the early days of the war, he co-operated with various dyestuff manufacturers in selecting and producing necessary colors for cotton dyeing and printing.

In 1917 Mr. Williams became chemical engineer at the Mt. Hope Finishing Company, which position he still holds—among his duties being the purchase of all dyestuffs and chemicals. When the United States entered the war he assisted in developing the necessary sulphur colors for the wide, heavy ducks and similar fabrics required by the Ordnance Department.

Mr. Williams has devoted lifelong study to the chemical engineering problems associated with bleaching, mercerizing, dyeing, printing and finishing of cotton and cotton-silk fabrics, and has given especial attention to the testing and evaluation of the dyes and chemicals required for these fibers. He has been a prominent contributor to the technical press on various textile subjects.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

R. L. B.—*Question*—Will you kindly advise me who in America is making Soluble Blue, red and green shades?

Answer—Soluble Blue is at the present time being manufactured by the National Aniline & Chemical Company, Sherwin-Williams Company and Dicks-David Company, to our knowledge, and there may be others of whom we are not aware.

J. C.—*Question*—Will you kindly advise me as to what industries are the chief consumers of Methyl Violet and about how much of it is used in this country annually? I should also be glad to know who is now manufacturing it in America.

Answer—This product is sold in three forms, crystals, lump and base, the crystals being the form usually used in America and the other two being used generally for export purposes, particularly the Far East.

Methyl Violet is used in the textile, paper, leather and ink industries, a large quantity being used both for type-writer ribbons and the manufacture of indelible pencils. During the last pre-war year a total of 255,063 pounds was imported, according to the records of Dr. Norton of the Department of Commerce. Various brands of this product are covered in the last edition of Schultz & Julius Farbstofftabellen under No. 515.

At the present time Methyl Violet is being manufactured in America by the National Aniline & Chemical Company, E. I. du Pont de Nemours & Co., Sherwin-Williams Company, Tower Manufacturing Company, H. A. Metz & Co., Dicks-David Company, and perhaps by other concerns with which we are not acquainted. Several importers are also offering this product.

D. K. M.—*Question*—You will greatly oblige us by advising if Magnesium Sulphate is used to any extent in connection with the dyeing of Sulphur Black on cotton hosiery, and if so, state how same is applied and results obtained.

Answer—After careful investigation we are of the opinion that the use of magnesium sulphate is very limited, if used at all, in connection with the application of Sulphur Black on cotton hosiery. We do not find any

literature on this subject nor have our inquiries directed to various mills using Sulphur Black discovered any who are employing magnesium sulphate in any way. One of the large manufacturers of Sulphur Black has, at our request, made a series of tests employing magnesium sulphate and reports to us that he finds no occasion to recommend its use.

H. C. Co.—*Question*—Will you please advise us of the nature and uses of Osage Orange Extract as a dyestuff?

Answer—Osage Orange Extract is a vegetable dyestuff very similar to fustic, yielding a yellow color. It is dyed in connection with a mordant, is particularly suitable for wool dyeing and, in certain cases, for silk. It can be used in almost every instance where fustic is employed.

The Osage orange tree grows along the Mexican border and the Osage orange extract as a dyestuff was developed by the United States Department of Agriculture in order to find a use for the chips and trimmings of Osage orange wood which is used largely in the manufacture of cart wheels in the very dry desert territory.

Review of Recent Literature

World Disarmament and the Master Key Industry. A collection of notable testimony bearing upon the role of the coal-tar chemical industries in warfare; 52 pages, 9x12; New York, American Dyes Institute, 130 West Forty-second Street.

At last the leading facts in the case of the dye industry vs. Government inaction are to have a vehicle for presentation to the public in their proper form, compactly and completely. Whereas heretofore they have had to depend on paper-covered pamphlets or typewritten circular letters, which, after all, compel anything but satisfactory attention, they may now be sent forth with full assurance that they will command respect and gain a hearing from many whose invariable custom it is to consign anything that looks like a propaganda-bearing folder, circular, dodger or what not, to the waste basket.

The compilation of these facts, of which the public knows so little, may be regarded as most fortunate and timely, and the American Dyes Institute has well served the needs not only of the dye industry, but of the entire country, for it has been demonstrated beyond doubt that the only way to overcome the political cowardice of our servants in Washington is by the overwhelming pressure of public opinion. As a moulder of that opinion the work under discussion should prove extremely potent if rightly applied. A number of months ago this department would have expressed a hope to see it in every textile or other dye consuming factory in the country; now, however, we would like to see it on the desk of every editor in the country,

accompanied by a supplementary letter asking for expression of the facts in the editorial columns and suggestions to readers that their representatives in Washington be advised of a strong local sentiment in favor of adequate protection for the dye industry. The dye consuming industries know the story by this time, and apparently can do little more to offset the efforts of the strongly organized pro-German lobby which is operating in Washington to cheat them out of an independent domestic source of supply. Further efforts to startle Congress from its apathy must come from citizens of the United States, as such—in other words, the VOTE (set in capitals because no Congressman ever thinks of it except as in capitals). And, make no mistake about it, the sum total of the influence of the editors is enormous. One of the gravest mistakes which one seeking support for his particular cause can make is to underrate the powers of the editor of the small "country" newspaper, published weekly. We have not been apprised of the plans for distributing this compilation, but in our opinion the smaller towns should be covered as completely as practicable.

The work is dedicated to the joint propositions that if we lose our new dye industry we must either remain armed to the teeth or accept the certainty that we cannot resist an attack by any dye-making country, and that nothing short of direct measures of exclusion can furnish the necessary shield for its protection. "The American Dyes Institute presents this book to the American people," states the introduction. It is to be earnestly hoped that it will indeed do so, to the limit of that organization's ability. Once made to understand the message which the book contains, the American people will do the rest.

Excellent "talking points" for editors are contained in the initial chapter, which bears the title of the entire work. It makes very clear the fact that "in a disarmed world the dye-making countries will reign supreme." Navies and armies can be limited, but "no nation will consent to any course of action, however uniform and universal, which decreases its safety, its relative power of resistance." Chemical warfare being the order of the day, a nation equipped with a self-sustaining dye industry is all but equipped for chemical warfare on a colossal scale—without making any drain on the public treasury meanwhile. "Already the chemists, to some extent without the aid of any existing weapon, and to an overpowering extent in conjunction with the older equipment, can provide an attack of hitherto unparalleled efficiency, while they alone can offer any adequate means of resistance." If every German munition works were destroyed, "the German dye industry could yet, partially at least, arm half the world." Hence, disarmament in its generally understood form will be out of the question for any country not so equipped.

Much of the material which the book contains has already been given to REPORTER readers. For instance, there are selected portions of the Watson speech, the

Frelinghuysen speech, the Knox speech and the Nugent speech made in the United States Senate. There is the original majority report of the House Ways and Means Committee and also of the Senate Finance Committee, and likewise the important articles on "Chemical Disarmament" by Major V. Lefebure, and "The Encirclement of Germany's Enemies by the Dye Industry" from Chapter II of "The Great Adventure of Panama," by Phillippe Buneau-Varilla. Leading the van is "Fighting with Fumes," consisting of extracts from chapter XII of Dr. Edwin E. Slosson's "Creative Chemistry," which begins: "The Germans opened the war using projectiles seventeen inches in diameter. They closed it using projectiles one hundred-millionth of an inch in diameter. And the latter were more effective than the former." This selection is an excellent one to use for an "opener," since it at once acquaints the reader with the nature of chemical warfare and prepares his mind for what is to follow.

An effective portion of the book is devoted to extracts from the testimony of army and navy officers and scientists, including Major-General W. L. Sibert, of the C. W. S.; Rear Admiral Ralph S. Earle, U. S. N.; Brigadier-General Amos A. Fries, U. S. A.; Colonels C. T. Harris and J. H. Burns, U. S. A.; Dr. Van H. Manning, Department of the Interior; Dr. Marston Taylor Bogert, Columbia University; Dr. Julius Stieglitz, University of Chicago and former president of the American Chemical Society, and Charles H. La Wall, U. S. Pharmacopoeia. There are also extracts from the *Congressional Record* and a section devoted to comment culled from sixty-odd trade journals, newspapers and consumer periodicals.

One of the most impressive articles in the collection is that of Dr. Charles H. Herty, editor of the *Journal of Industrial and Engineering Chemistry*, from which we cannot refrain from quoting:

"... We are slipping back, back to the dull routine of pre-war days, to unaccustomed, petrified thoughts of war-making. Unceasing effort for more than a year was required to arouse a dynamic interest in gas warfare, after we were actually in the war. Many American lives were lost because of that delay. . . . To-day the army has practically no modern gas masks. The same is true of the national guard. Through the army and navy appropriation bills the House of Representatives has set aside a total of \$724,000,000 for our fighting forces and of this amount only two-tenths of one per cent is available for gas warfare, which was responsible for one-third of our casualties."

Something is urgently needed to restore the mental balance of our friends in Washington. Widely distributed, we believe that this book will have sufficient effect on the press, and in turn on the public, to bring about an overwhelming protest. We sincerely recommend that every friend of protection for the American dyestuff industry take it upon himself to secure a copy and bring it to attention of all who are in any uncertainty as to the necessity of protective legislation.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of
dyestuffs and the mechanical equipment incidental thereto

VOL. 8, NO. 18
MAY 2, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

Walter M. Scott, Ph.D., Chief Chemist to Cheney Bros., presents an article on the fastness requirements of dyes for silk, accompanied by a table of actual results obtained by the use of German colors and American equivalents therefor, which goes a long way toward proving that American dyes have "arrived."

Part IV of Professor Louis A. Olney's article on "Operations Preliminary to Dyeing Wool Fiber" deals with the technique of wool scouring.

The first instalment of a two-part article by R. R. Sleeper on "Uneven Piece Dyeing of Woolens and Worsteds" deals with methods for overcoming commonly met difficulties in the dyeing of woollen piece goods.

Raffaele Sansone outlines various methods for proofing the value of aniline oil.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 8, No. 18

NEW YORK, MAY 2, 1921

Section 2

Fastness Requirements of Dyestuffs by the Silk Industry

A Brief Discussion of Various Fastness Properties as Required by Different Classes of Silk Fabrics, with an Accompanying Table Showing Records of Tests Made

By WALTER M. SCOTT, Ph.D.

Chief Chemist, Cheney Bros., South Manchester, Conn.

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IN order to get a clear conception of the various tests which dyestuffs, when applied to the silk fiber, must undergo to be perfectly satisfactory, it is necessary to take into consideration the various uses for which the finished materials are intended. Because of this fact, it seems advisable first to call attention to the main classifications under which practically the entire output of manufactured silk goods may be listed.

The five groupings as shown below are of necessity more or less arbitrary and fall along the lines of the writer's own experience. They will, however, serve as a basis to which the fastness properties of the different dyestuffs may be co-related.

Class I. Dress Goods.—This is by far the largest division and includes the common types of georgettes, crepes, twills, surahs, satins, etc., as well as velours, chiffons and other types of velvets.

Class II. Upholstery Fabrics.—Including a wide range of jacquard woven tapestry effects, and also a large assortment of velvets, principally cotton-backed

Class III. Decorative Goods.—A grouping of all materials intended for curtains or hangings of any description.

Class IV. Ribbons.—Among which neckties are also listed.

Class V. Hosiery.

Even a casual glance at the above groupings will show the reader that the same requirements for fastness do not apply to all types. For instance, it is very important that all the dyestuffs used in Class I should be fast to perspiration, but this is not at all an essential point in II and III. This leads us directly to the discussion of the various types of fastness required and the extent to which they are essential in each of the five groups.

The first, and undoubtedly the most important, consideration is the fastness to sunlight. This might be expressed more properly as fastness toward fading action of any sort, as it has been demonstrated that a number of artificial lights in a concentrated form have an even greater capacity for the promotion of fading than sunlight itself. It is also true that certain conditions of humidity in the atmosphere exercise a noticeable fading effect without the assistance of any direct sunlight.

COMPARATIVE FASTNESS TO LIGHT TESTS

In a recent article published in the AMERICAN DYESTUFF REPORTER for October 11, 1920, the writer described a method which is satisfactorily used for determining the comparative fastness of dyestuffs toward light. The main problem was to determine a definite standard for fading action and to keep this standard constant through the varying seasons of the year. After considerable experimentation the well-known dyestuff Victoria Blue B was chosen to act as a fading standard because of the fact that it fades quite uniformly and fairly fast. A standard dyeing of this blue was exposed under glass to 100 hours of June sunlight as closely as it could be estimated, care being taken to allow good circulation of air around the sample. The deep blue was changed to a distinctive light bluish gray, which then became the standard for fading. A strip from a standard dyeing of Victoria Blue B is put out with every set of samples, and they are exposed until the blue reaches the standard shade of gray.

Any dyestuff whose standard dyeing on silk, as described in the previously mentioned article, shows no noticeable change when exposed to the equivalent of

100 hours of June sunlight may be considered of excellent fastness to light. In order to give the most satisfaction it is essential to use only such colors as far as possible for the dyeing of Classes II and III.

Any dyestuff whose standard dyeing loses strength up to approximately 50 per cent of the original color value when exposed to the same standard fading test may be considered a fair fastness to light. Such colors may be used with perfect satisfaction, so far as this particular property is concerned, for the dyeing of Classes I, IV and V.

Any dyestuff whose standard dyeing under the same conditions loses more than 50 per cent of its original color value must be considered of poor fastness to light. However, many colors in this group can be used without any danger of complaint for a wide variety of dress goods, where the question of light fastness is a minor consideration. In fact, some of our brightest acid and basic dyes which are absolutely essential in obtaining a number of fashionable shades show an extreme fugitiveness to the direct action of sunlight.

FASTNESS TO WASHING

The second consideration with all dyestuffs is their fastness to washing, or, in other words, to soap solutions of varying temperatures. Here again it is possible in a rough way to make three general divisions, using a 1 per cent soap solution as the standard of comparison. In the first group, which again may be called excellent, are placed all colors whose standard dyeings on silk when immersed for five minutes in the above soap solution at any temperature, from 140 deg. Fahr. up to the boil, show no loss in shade and no discoloration of the solution. Dyestuffs of this type are required for the dyeing of Class V and for certain specialties in Classes I and IV, such as wash-fast shirtings, wash ties, etc.

In the group of fair fastness may be listed all colors whose standard dyeings on silk when immersed in the same strength soap solution, at any temperature from 100 to 120 deg. Fahr., show no appreciable loss in shade and very slight, if any, discoloration of the solution.

The remaining dyestuffs which show an immediate tendency to bleed when immersed in a lukewarm soap solution of the above strength, from 80 to 100 deg. Fahr., and are stripped off from the silk more or less completely in a period of five minutes, must be called of poor fastness. The members of the last two groups are applicable to Classes I, II, III and IV, provided that reasonable care is taken in each case to choose the colors whose properties are best suited for the intended use of the goods.

It is also possible to pick out from the last group certain dyestuffs which are so fugitive that they show an immediate tendency to bleed off from the silk when the standard dyeings are immersed in lukewarm water.

It is advisable to use colors of this sort as little as possible, and then only in the classes of goods which the public knows to be non-washable.

CHANGES OF CAST IN ARTIFICIAL LIGHT

Another type of fastness which plays an important part in Classes I, II and III is the fastness toward the ordinary types of artificial light. For instance, it is conceivable that the whole decorative scheme of a room might be upset if the blue which was used to dye certain of the hangings turned noticeably redder under artificial light, while the blue used in an adjacent piece remained the same or even became greener. Thus these two colors, which were perfectly harmonious in daylight, would have exactly the opposite effect when the artificial lights were used. The same clashing of hues is liable to occur in the different materials which are used for a dress, so that particular attention must be paid to this detail in the testing of dyestuffs for the above-mentioned classes. As a general rule, it is best to use only such dyes as maintain the same shade under natural and artificial lights, and especially to avoid any which show a tendency to redden under the latter. A change to a slightly greener tone is not quite as objectionable.

Another fault which must be guarded against is the tendency of a dyestuff to crock or rub off when dyed in a deep shade. This is easily tested for by making a fairly high percentage dyeing (from 5 to 10 per cent) of the color in question on a small satin patch, and rubbing a moist piece of white silk or cotton vigorously across the face. If the white fabric is noticeably stained, the dyestuff is only fit for use in light to medium shades.

Finally, there are two special types of fastness to be taken into consideration in connection with Class I; namely, fastness to perspiration and to ironing. There are a number of laboratory solutions designed to test the former property in which either salt and acetic acid or carbonate of soda usually play a part, but in any doubtful cases the writer prefers to make a practical trial with the co-operation of one of the workmen in the dyehouse.

The fastness of a dyestuff toward a hot iron is important principally in the dyeing of piece goods. It sometimes happens that a dyestuff will change noticeably in shade under the influence of heat and will be very slow in regaining its original hue. In dyeing a piece with such a dye, when a sample is taken off and dried on the cam it may appear entirely different than it will some hours later. Under such conditions it is almost impossible to obtain a close match in any reasonable length of time, so that dyestuffs of this sort should be avoided as much as possible.

In conclusion, it will be seen that it is essential to have close co-operation between the dye-testing laboratory and the various dyeing departments in the

(Continued on page 14.)

COMPARATIVE FASTNESS TESTS OF GERMAN AND EQUIVALENT AMERICAN DYESTUFFS

(For Detailed Explanation of Table See Page 14.)

DYESTUFF GROUPINGS		GERMAN COLORS		AMERICAN COLORS		FASTNESS PROPERTIES ON SILK					CLASS OF GOODS BEST SUITED FOR
Hue	Type	Name of Dyestuff	Schultz No.	Name of Dye and Makers' Nos. Per 1919 Census	Light	Washing	Perspiration	Crocking	Artificial Light	Ironing	
Black	Acid	Agalma Black 10B	217	Acid Blue Black 5, 27, 40, 53, 64, 75, 92, 112, 116, 120, X	Excellent	Poor	Excellent	Fair	Slightly Redder	No change	Class I (limited)
	Developed	Naphthamine Fast Black VEC		Fast Black V 116	Fair	Excellent	Excellent	Excellent	No change	No change	" V
Blue	Acid	Patent Blue V	543	Alphazurine G 112	Fair	Poor	Excellent	Excellent	Slightly Greener	No change	" V
	Acid	Alizarine Sky Blue B	855	Alizarine Sapphire 112	Excellent	Poor	Excellent	Excellent	No change	No change	" I
	Acid	Induline (Water Soluble)	858	Induline 18, 53, 64, 69, 112	Excellent	Poor	Excellent	Excellent	No change	No change	" II, III
	Basic	Victoria Blue B	699	Victoria Blue B 23, 24, 53	Fair	Poor	Excellent	Excellent	Slightly Redder	No change	" II, III
Brown	Direct	Benzamine Pure Blue	559	Direct Sky Blue 53, 75, 112, 116, 154	Poor	Fair	Excellent	Fair	Slightly Greener	No change	" IV
	Direct	Naphthamine Brown 3G	426	No Substitute	Excellent	Fair	Excellent	Excellent	No change	No change	" IV (limited)
Green	Acid	Acid Green 2G	505	Acid Green 31, 69, 112	Fair	Fair	Excellent	Excellent	No change	No change	" I
	Acid	Anthraquinone Blue Green BXO	863	Alizarine Green SX 64	Excellent	Poor	Excellent	Excellent	No change	No change	" IV
Gray	Basic	Brilliant Green Crys.	499	Brilliant Green Crys. 69, 95, X	Excellent	Poor	Excellent	Excellent	No change	No change	" I
	Acid	Fast Gray B	681	New Fast Gray 68, 116, X, X	Fair	Fair	Excellent	Excellent	No change	No change	" II, III
	Direct	Benzo Fast Black L		No Substitute	Poor	Fair	Excellent	Excellent	No change	No change	" IV
	Acid	Orange II	145	Columbia Black FF 112	Excellent	Fair	Excellent	Excellent	No change	No change	" I
Orange	Acid	Benzo Fast Orange S	147	Orange II, 5, 24, 27, 53, 57, 64, 69, 112, 117, 120, 136, X, X, X	Fair	Poor	Excellent	Excellent	No change	No change	" II, III, IV
	Acid	Azo Fuchsin 6B		No Substitute	Fair	Fair	Excellent	Excellent	No change	No change	" IV
Red	Acid	Alizarine Rubinolet R	161	Azo Fuchsin 6B 64	Excellent	Poor	Excellent	Excellent	No change	No change	" I
	Acid	Fast Red A		Fast Red A, 5, 27, 53, 69, 112, 116, 120, 136, X	Fair	Fair	Excellent	Excellent	No change	No change	" II, III
	Basic	Rhodamine B Extra	573	Rhodamine B Extra 53, 116	Fair	Fair	Excellent	Excellent	No change	No change	" IV
	Developed	Primuline (Beta Naphthol)	616	Primuline 18, 112, 123, X, X, X, X	Poor	Fair	Excellent	Excellent	No change	No change	" I, IV
Violet	Direct	Diamine Scarlet 3B	319	No Substitute	Fair	Fair	Excellent	Excellent	No change	No change	" V
	Direct	Diamine Fast Red F	343	Direct Fast Red F 53, 92, 112, 116	Fair	Fair	Excellent	Excellent	No change	No change	" I, IV
	Acid	Violamine R	582	Violamine R 24, 95	Excellent	Fair	Excellent	Excellent	Slightly Redder	No change	" I, IV
	Basic	Methyl Violet	515	27, 49, 53, 66, 69, 74, 112, 117, 146, 171, X	Poor	Fair	Excellent	Excellent	Much Redder	No change	" II, III, IV
Yellow	Acid	Tropaeoline O	143	Resorcinol Yellow 69	Poor	Fair	Excellent	Excellent	No change	No change	" IV
	Acid	Fast Light Yellow 2G	19	*Xylene Light Yellow 2G	Excellent	Poor	Excellent	Excellent	No change	No change	" I, IV
	Basic	Chinoline Yellow	22	*Chinoline Yellow	Excellent	Poor	Excellent	Excellent	No change	No change	" I, II, III
	Basic	Phosphine	613	Phosphine 69, 72, 112	Poor	Poor	Excellent	Excellent	No change	No change	" I, II, III
	Direct	Chrysophenine G	606	Chrysophenine 58, 112, 116, 165, X	Poor	Fair	Excellent	Excellent	No change	No change	" I, IV
	Direct		304		Excellent	Fair	Excellent	Excellent	No change	No change	" I, II, III, IV

Note:—*Manufactured in Switzerland.

FASTNESS REQUIREMENTS OF DYESTUFFS BY SILK INDUSTRY

(Concluded from page 12.)

plant. No dyestuff is perfect. For instance, the widely advertised vat dyes, which possess extreme fastness toward all destructive agencies, lack in many cases the brilliancy which is demanded by certain mode shades. It is the function, then, of the laboratory to pick out the best dyestuffs for the various types of material and, with the assistance of the dyer, to guard against using any color for purposes for which it was never intended.

EXPLANATION OF TABLE

In order to bring home the definite relationship which should exist in each individual case between the laboratory tests on fastness and the application of the dyestuff to special classes of goods, the writer submits the accompanying table, in which are listed all the common types of dyes, with the exception of the vat colors, which can be successfully applied in silk

dyeing and printing. This table is based on the German standards, which were adopted before the war by the firm with which the writer is associated as being best adapted for the purpose in hand. Consequently, it also serves to show how far the American manufacturers have progressed in satisfying the needs of silk dyers and printers. The dyestuffs are classified first according to their hue, and then their dyeing properties. The Schultz number is given wherever possible, and if the American substitute corresponds exactly to this number it is listed in the same line, but if slightly different in type it is listed directly below. The numbers given refer to the classification of dye manufacturers in the 1919 census of the United States Tariff Commission. The general divisions under the headings of fastness toward light and washing are explained in the body of this article, while the rest are self-explanatory. The five different classifications of the finished silk goods are defined in the first few paragraphs.

(Editor's Note.—Attention is called to the editorial on page 22 entitled "Irrefutable Evidence," which presents supplementary data supplied by Dr. Scott.)

Operations Preliminary to Dyeing Wool Fibre Part IV—Machinery Used and Detail of the Process of Wool Scouring

General Character of the Process and Modifying Influences Which Govern the Procedure

By LOUIS A. OLNEY

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THE detail of procedure in scouring wool with one of the continuous scouring machines varies not only with the character of the wool and the number of bowls that are available but also with the experience and fancy of the wool scourer. The rule of thumb is still quite evident in many scouring plants, and in general it may be said that the process of wool scouring is by no means upon as scientific a basis as the process of bleaching cotton.¹¹

This is due very largely to the fact that much more actual chemistry is involved in cotton bleaching than in wool scouring. The great variety of chemical reactions taking place during the numerous steps of cotton bleaching have made it obligatory for chemists to study them carefully and note the changes brought about as a result of their variation. Wool scouring, on the other hand, involves physical far more than chemical phenomena, and the necessity for scientific study is not so evident and, therefore, not thought so

essential. As a result, much has yet to be learned in regard to the action of reagents upon wool fiber and the actual conditions of temperature in relation to concentration of scouring bath and other details of the process which are the controlling elements in the condition of the wool when it leaves the scouring machine.

As already stated, seldom less than three, and frequently four and five, scouring bowls are used in a tandem arrangement. Modern types of such scouring bowls are illustrated in Figs. 10 and 11. As shown in Fig. 10, the two bowls are connected with a "carrier"; but when the bowl illustrated in Fig. 11 is used, the carrier is omitted and the "chute table" shown in Fig. 12 conveys the wool from one bowl to the next. The selection of one type in preference to the other is based largely upon the length of staple of the wool to be scoured. In general, the "chute table" is recommended for long wools and fine wools with felting

¹¹ This statement applies to the detail of the process as to choice and use of scouring agents and control of temperature, rather than machinery used; for the lat-

ter has been developed to a very high state of perfection, as is evident from the illustrations of continuous scouring machines which accompany this article.

properties, while the "carrier" is best adapted to the shorter wools and wools which do not felt too readily.

The number of bowls which may be used in series controls to a certain extent the nature of the scouring liquor used in each. In general it may be said that when three bowls are used alkali alone or alkali and soap may be used in the first, alkali and soap or soap alone in the second, and clear warm water in the third. When there are four bowls, alkali in the first, alkali and soap in the second, soap or a little ammonia in the third, and clear warm water in the fourth. When there are five bowls, alkali in the first, alkali and soap in the second, soap in the third, warm clear water with or without a little ammonia in the fourth, and clear warm water in the fifth.

Some scourers prefer to supplement their series of three bowls with a rinse box for the final washing. Such a rinse box is shown in Fig. 13, and consists of a large wooden tank into which a metal tank, with a perforated bottom, containing the wool may be lowered. Clear water is circulated through this with considerable force, and the wool is thus given a thorough washing. When the washing is completed the tank, which is hinged by a shaft at one end, is raised to the position indicated. The excess of water rapidly drains out through the perforated bottom, and the wool slides down the incline and is easily removed. It is claimed by those using rinse boxes that this method of washing is more effective than an extra bowl in removing the last traces of dirt.

Occasionally only warm water is used in the first bowl of the series. This procedure may be followed when there is a desire to recover potash salts, or in a series of four or five bowls for the purpose of softening the wool and removing some of the excess dirt and keeping the second bowl cleaner. In this case the second bowl, so far as actual scouring is concerned, becomes the first bowl of the series, and by this method the scouring liquor can be kept cleaner and consequently used a longer time.

In some plants a small quantity of sodium hydro-sulphite is added to the final rinse water. This exerts a decidedly reducing action and tends to clear the color of the wool through its slight bleaching action.

FINAL WASHING OF WOOL

Special attention must be given to the final washing of the wool, and care taken that the soap is completely washed out. This is best accomplished by using plenty of warm water in the last bowl, and under no condition should the wool be suddenly plunged from a warm soap bath into one of decidedly cold water. Such a sudden chilling of the soap is quite likely to temporarily deposit it upon the fiber and render its removal more difficult. Should any soap remain with the wool and become dried on, it would be difficult to remove later and would also react with any acid in a subsequent dye bath, liberating the insoluble free fatty acid of the soap.

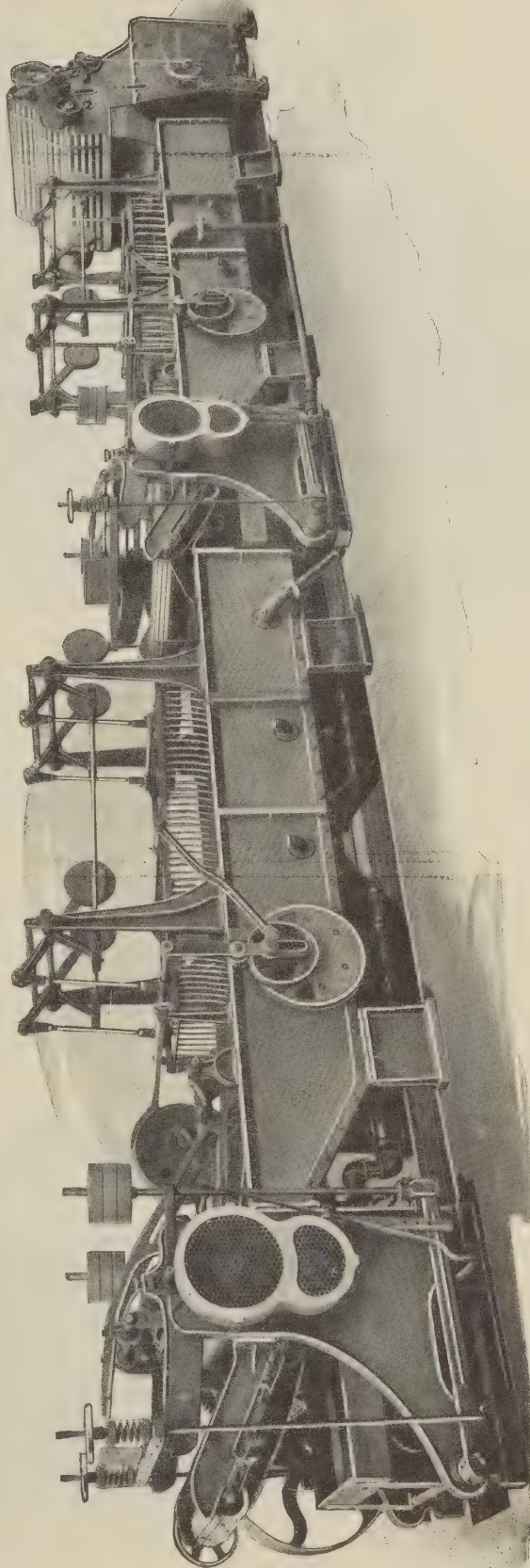


FIG. 10—Two Sixteen-Foot Model 34 Borels, Equipped with Model L Feed and Carrier—C. G. Sargent's Sons Corp.

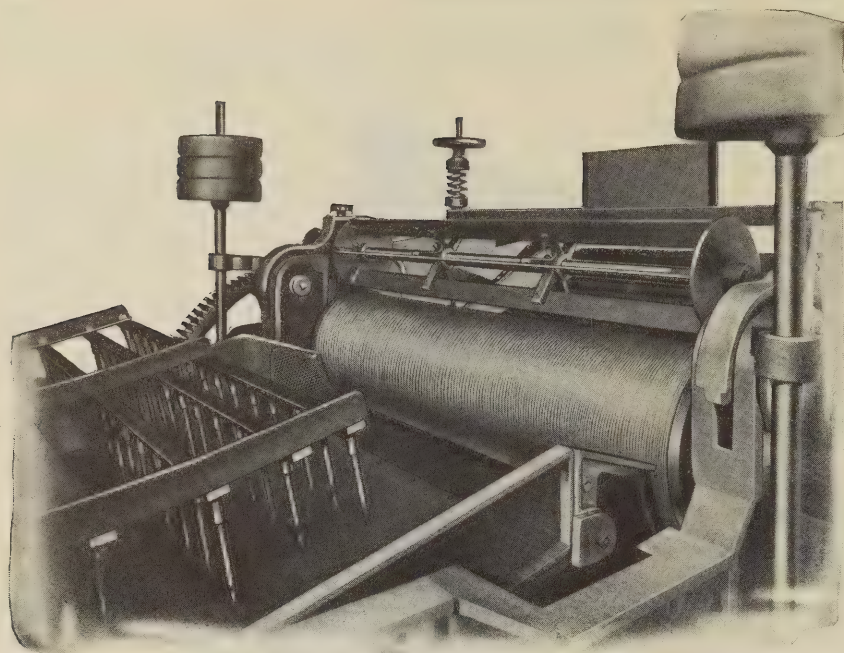


FIG. 12—Chute Table of Model 35 Bowl—C. G. Sargent's Sons Corp.

Care must also be taken that the final wash water is free from the calcium and magnesium compounds which are present in hard waters, as these react with the soap, forming the insoluble calcium and magnesium soaps, which tenaciously adhere to the wool and are removed only with great difficulty, if at all. The presence of either the free fatty acid or the insoluble soaps upon the wool will tend to produce undesirable results in subsequent dyeing processes.

CHANGING THE SCOURING LIQUOR

The economical management of the scouring process depends to a considerable degree upon the systematic changing of the scouring liquor. When the liquor in the first bath becomes so laden with impurities that it

can no longer be used it is discharged and the cleaner liquor from the second bowl pumped over into the first by means of a rotary pump. To this is added the proper quantities of alkali, and soap if necessary, and the first bowl is thus brought up to the desired strength. Meanwhile the scouring liquor in the third bowl has been pumped into the second and the proper additions made, and same procedure follows with the fourth and fifth bowls, if there are that many in the series. In adding alkali it is a common custom to place the undissolved compound in the perforated ducker trays and, by keeping the machine running, solution is quickly effected. The soap is sometimes added in the same manner; but as this is more difficult to dissolve, it is better to make up a concentrated solution of the soap in a special tank and add it in this form.

The scouring bowls illustrated in Figs. 10 and 11 are so constructed as to give an efficient settling action beneath the false bottoms, and the suspended dirt is gradually deposited in the multiple hopper bottoms. Each hopper is provided with a draw-off valve, which renders it possible to rapidly empty the spent liquor of any bowl, the flush being sufficient to thoroughly clean the side walls of sediment.

CONCENTRATION OF SCOURING BATHS

The strength of scouring baths varies so, with the nature of wool and its accompanying substances, that it is impossible to establish any fixed rules in this respect. In general, it may be that from 2 to 6 pounds of soap and from 5 to 12 pounds of alkali per 100

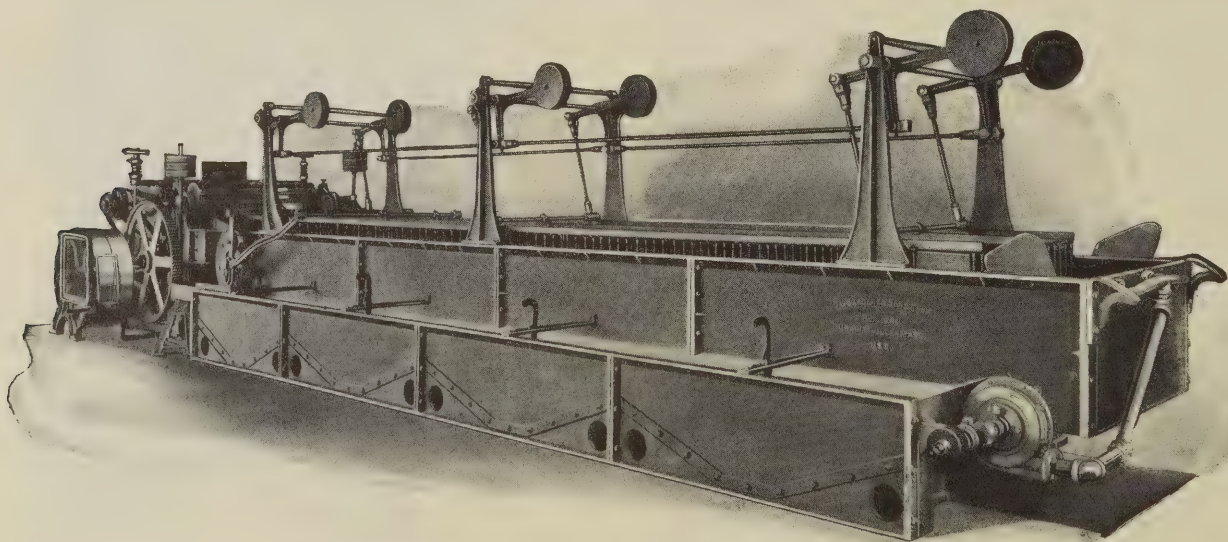


FIG. 11—Twenty-seven-Foot Model 35 Bowl, with Settling Tank—C. G. Sargent's Sons Corp.

gallons of scouring liquor represent the customary range of concentration.

The relative proportion of the two used varies with the position of the bowl. Generally there is considerably more alkali than soap in the first bowl, whereas in the second bowl the alkali is greatly reduced and the soap increased, and alkali entirely omitted from the third bowl. The exact concentrations to be used in any case can only be determined by experience, and the expert wool scourer varies the quantities of the scouring agents added, in accordance with the character of the raw wool, the nature of the water used as to softness, and careful observation of the results obtained. In most instances sufficient soap should be used to keep a slight lather upon the surface of the scouring liquor and as little of the alkaline carbonate as will satisfactorily scour the wool. An excessive lather usually results from the use of too much soap, while the entire absence of surface bubbles commonly indicates too little. The quantity of alkali which may be safely used is by no means directly proportionate to the total wool grease present upon the fiber; in fact, it may in some cases prove to be more nearly an inverse ratio. This is due to the fact that the finer the wool the less able it is to resist the action of alkali, and the finest wools are frequently accompanied by the highest percentage of wool grease. An excess of alkali has a tendency to yellow the wool and impair its luster and feel. The use of too little alkali usually results in the incomplete removal of the wool grease.

RELATIVE TEMPERATURE OF BOWLS

The temperature of different bowls also varies somewhat with the different types of wool, but to no such extent as the quantities of reagents that may be used. The temperature of the first bowl is usually between 115 and 120 deg. Fahr., and this may frequently be increased to advantage a few degrees in the second, but ordinarily should not go over 125 to 130 deg. Fahr. The temperature of the third bath is usually lowered a little, and may be dropped a little in each successive bowl. Much difference of opinion seems to prevail as to the temperature of the final wash water, some even using cold water; but, as has already been stated, unfavorable results are likely to develop if the wool is too suddenly cooled before the last traces of soap have been removed. Too high a temperature yellows the wool and tends to unduly tender it, while too low a temperature retards the emulsification of the wool grease and results in its incomplete removal. As stated in an earlier paragraph, the generally accepted range of temperature is between 110 and 130 deg. Fahr.

RATE OF SCOURING

The length of time required for the scouring proc-



FIG. 13—The First Rinse Box Built by C. G. Sargent's Sons Corp. Modern Types Are Similar in Operation

ess should at all times be reduced to a minimum so far as the action of alkali and soap is concerned. The prolonged action of either of these beyond the time actually required to remove the wool grease is detrimental rather than beneficial.

On the other hand, any attempt to increase the speed of the machines means also more violent agitation of the wool, which in the presence of alkali, soap and an elevated temperature means an increased danger of felting. The more gently the wool can be handled and the desired result accomplished, as far as the scouring is concerned, the better condition it will be in for carding and spinning. The rate at which the wool can be passed through the bowls is therefore an element in determining the strength of the scouring baths.

(To be continued.)

The usual dressing for silk open-work material is gelatine. Refined gelatine is dissolved in water to make a thin, limpid solution, and this is applied to the goods after they have been dyed by immersing directly, and afterwards hydro-extracting. The fabric is then run over the tenter machine, where it is stretched and dried to the proper width. The gelatine solution, as it dries, leaves on the threads composing the fabric a very fine deposit of gelatine, which acts as a binder for the threads, cementing them together, as it were, and preventing the goods from "springing back."

The Production of Even Dyeings on Cotton Skeins in Hussong Dyeing Machines

A Summary of the Common Causes of Unevenness in Skein Dyeing, with Suggestions for Avoiding Them

By HECTOR G. McDONALD, B.T.C.

EVERY dyer has more or less frequently been up against the proposition of unevenness in his work. So many things may cause this undesirable condition that the dyer must constantly be on the alert to avoid it. In connection with this article the writer is limiting himself to skein dyeing as carried out with the use of the Hussong dyeing machine. Much of the preliminary treatment necessary to obtain even dyeings on cotton skeins is adaptable for use not alone with this particular machine but also with machines of other types.

PRELIMINARY TREATMENT OF SKEINS

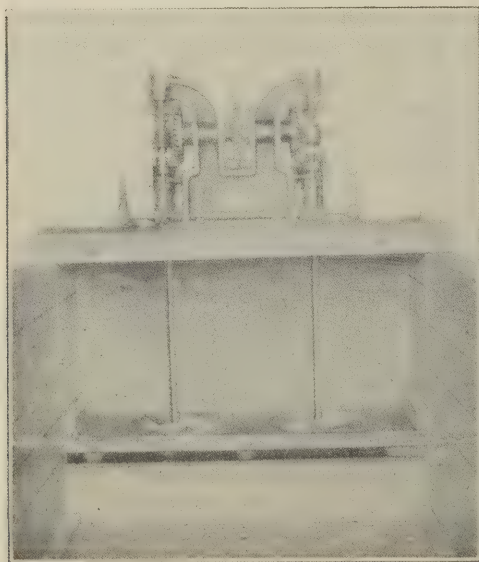
To secure even dyeings the cotton skeins must, with the possible exception of those going into a sulphur black, be given a certain amount of preliminary treatment. Even those skeins going into sulphur black dye up much more readily and better if at least wet out in boiling water before entering the black kettle. In cases where there is room in the kier and a sufficient supply of yarn ahead for the black kettle, skeins going into this color can well be boiled along with those going into other colors.

In preparation for boiling, the heads of yarn should be well loosened from the bundles and the knots in

the bands also well loosened. This loosening of the knots where two skeins are tied together to form a band not only prevents the skein from being unevenly dyed, due to the tightness of the knot preventing thorough boiling out, but saves time, as with some yarns they are almost impossible to undo after having been boiled. It is not essential that caustic, soda ash or other boiling compounds be used in the boiling-out process, except with yarns going into bleached colors. Their use, however, leaves the yarn a lot cleaner and more easily penetrated in the dyeing, and also cuts the time of boil.

Open or pressure kiers may be used with no difference in the final results; but, of course, a much longer period of boil is required in the open kier. Improper packing in the kier is liable to result in channels being formed, and the heads along the sides of these channels will oftentimes come up a different shade after being dyed than those lying in another part of the kier during the boil. This is due to the heads along the channel being more thoroughly boiled out.

After boiling, the yarn should be washed thoroughly, especially where caustic or some other ingredient has been used in the boil. Even a very small amount of caustic left in the skeins will cause unevenness by causing a heavier shade to appear on those having the most caustic left in them, due to the fact that the caustic increases the affinity of the cotton for the dye. After washing, the yarn should not be allowed to lie around the dyehouse unless covered. Care also should be taken in amount of yarn boiled up ahead of the dyeing machines. About two days' supply in advance of the machines is plenty, for if the yarn stands around the outside of the truckload may dry out. If this is not wet out before entering the kettle, the dry part generally comes up a little heavier than the wet portion and sometimes streaky. The possible explanation of this is that the water in the wet portion of the yarn dilutes the dye liquor as it first comes in contact with it, thus allowing the dry portions to be acted upon for a short period by a more concentrated liquor. Of course, in a very short time the concentration of the dye liquor becomes equal in all parts of the kettle. Then, also, this unevenness may be due to slower penetration of the dry yarns than the wet, thus allowing more dye to be deposited on the out-



Sectional View of Hussong Dyeing Machine, Showing Reversible Circulators

side threads, giving it the appearance of a heavier shade. Another feature which is caused by drying out of the yarn is the formation of rust when caustic has been used in the boil and the water contains some iron. This is also often a sign of insufficient washing. The yarn does not have to become thoroughly dry for this to appear, but the exposed parts of the truckload alone acquire this rusty coating, while those parts away from the air remain unaffected. This rust will cause a decided unevenness to appear, even in heavy shades of brown, and in extreme cases, where the yarn had lain around some few days, could be seen in black yarn.

The presence of alkali, when not well washed out, may cause one load to come up a heavier shade than one better washed, even under the same conditions of dyeing and with the same amount of dyestuff used. Covering the yarn while waiting for dyeing will not only keep it from drying out but will also protect it from water dropping on it from moisture collecting on overhead pipes and the ceiling, as well as from oil from overhead bearings in the shafting. The water may cause stains, or the oil form a resist, leaving a white spot in the yarn. Then, too, it is protected against stains from floating particles of dye, or those from coming in contact with dyed yarn or the soiled clothing of workmen. Care in these matters will often prove a solution of some cases of unevenness where every precaution has been taken in the dyeing proper.

LOADING OF THE HUSSONG MACHINE FOR DYEING

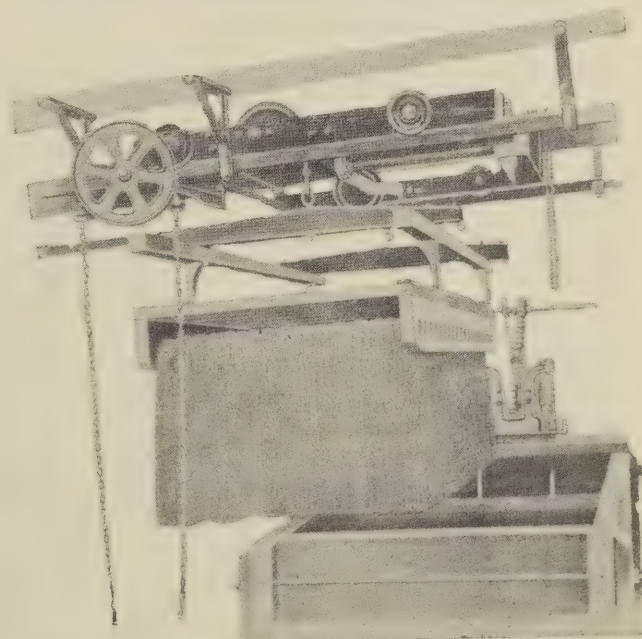
A good many cases of uneven dyeing of the skeins in a Hussong machine may be traced directly to improper loading. The heads should be opened out on a horn and the skeins in each head be straightened out before being placed upon the cross-bar of the dyeing carriage or rack. The amount of yarn placed on each cross-bar will depend upon the capacity of the machine and the number of cross-bars. The important thing is to have the yarn spread evenly on the cross-bars and the whole load distributed evenly on the rack. This may be done by counting the number of heads in each bundle and the number of bundles which are in the load for the rack. Then, by dividing the total number of heads in the bundles by the number of cross-bars the result will be the number of heads on each cross-bar necessary to hang the load up evenly. If the load is not thus evenly distributed and the yarn is stuck up carelessly and unevenly the chances are that the dye will not penetrate evenly to all parts of the load. Those skeins which are hung together closely will come up uneven. This does not mean that each cross-bar should have exactly the same weight of yarn on it, but only that care should be taken not to have five heads on one and eight on another. While the yarn is being straightened on the horn care might also be taken to have the place on the skein where it is tied hang in such a position as to be on the side of

the skein and not resting on the cross-bar. This is not a necessity but often prevents unevenness caused by the binding thread being too tightly drawn or the weight of the yarn hanging on the cross-bar at this spot not allowing as free penetration as in some looser part of the skein.

Skeins which have been boiled out in caustic or soda ash should not be put in the same load with those which were boiled out in plain water, as they have a tendency to come up heavier in shade, particularly if all of the alkali has not been washed out. Of course, if the load were 300 pounds and 100 pounds of this had been boiled with caustic, it could be put in the load providing it was kept together and taken off separately. However, at the time of sampling, this lot must be remembered and allowance made for its probable difference in shade.

Yarns of different sizes can be dyed together if desired, but they are likely to vary in shade. For instance, single yarns like 3's and 6's dyed in the same load will show little, if any, variation of shade. However, if you allow a load to be made up of a single 20's yarn and a two-ply 40's or a three-ply 6's there will be a marked difference in shade in the two sizes of yarn. Of course, if each size of yarn is a separate lot and is to be used apart from the other, there is no harm in making up a load in this manner, if the difference in shade with the sample matched is allowable.

Another important item, in loading to prevent unevenness, is to load with respect to the capacity of the machine. In other words, the machine should not be loaded beyond the capacity for which it is built. A machine which is built to hold 300 pounds of yarn might dye 325 pounds without much danger of unevenness; but, this having been done, there is a tend-



*Hussong Dyeing Machine, Showing Yarn Rack
Suspended Above Vat*

ency to put a little more on, and then a little more with each successive dyeing. Finally there comes a load which is uneven, and with it arises the question, Why? Remember, the machine was built for 300 pounds and the kettle was built to hold enough liquor for this amount of yarn to be dyed in properly. To allow for the extra amount of yarn more dyestuff has been added, and into this stronger dye liquor has been lowered more yarn than can be cared for by this amount of liquor. Perhaps the yarn has been crowded a little to get the extra yarn on. The loose ends are easily penetrated, but on the cross-bar where it is crowded the penetration is slower with a different rate of absorption and an unevenly dyed lot of yarn results.

Nor is this the only way in which unevenness may result from overcrowding. The dye, of course, is well dissolved in a pail or a barrel before being added to the kettle, but there is danger that undissolved particles may enter and, during the stirring of the kettle, lodge against the side. Perhaps the sides of the kettle are a little dirty, or scum or froth from the liquor has collected along them. When the overloaded rack of yarn is lowered into the kettle the yarn may rub or rest against the sides of the kettle and become spotted, dirty and uneven. With only the normal load on the rack there would have been ample room for the load to be lowered without the yarn rubbing the sides of the kettle. Underloading has none of these dangers and does not give much tendency to uneven dyeings; however, it takes a little heavier percentage of dye for the same shade. In short, if the load is hung evenly, distributed evenly on the bars, the machine loaded to capacity or at least not exceeding a 10 per cent overload, and a little care used as to the selection of yarns, there is slight chance that the loading of the machine will cause uneven dyeing.

CARE AND OPERATION OF MACHINE

With the rack loaded after the manner described above, there may be causes of unevenness arising from the care or faulty operation of the machine. If the Hussong machine be used as a stock-dye kettle it should be emptied occasionally and washed out well to remove the sediment and dirt which collect. This should be done at least every other week, or more frequently, depending on conditions existing. If this dirt and sediment are not thus occasionally removed they will have a tendency to darken the shade, or even cause it to be uneven. This collection of sediment and dirt is due to impurities present in the salt, and sometimes insoluble matter in the dyestuff. Dirt and dust from the air will collect and help increase the deposit, while at the same time the scum and froth which form during the boiling while dyeing or while the kettle is being boiled up will collect along the sides of the kettle and soil or discolor the yarn. If this scum should contain any dyestuff which enters

the kettle in an undissolved state and then collects on the yarn, it will leave a stain having almost a metallic luster, which is very hard to remove. Covering the kettles at night will keep a great deal of dust out. Then, too, if exhaust steam is used for heating, oil will often collect, and if this strikes the yarn it will act as a resist to the dye and cause a light spot.

Where the kettle is used for different shades it should be boiled out, before making up the next shade, with the addition of a little chemic and soda ash and then rinsed well. This keeps the kettle clean and prevents the shade from being thrown off by the presence of small amounts of color from the previous bath or from color bleeding from the sides of the kettle. Each bath should be made up with as near the same amount of water as possible, the reason for this being explained a little later.

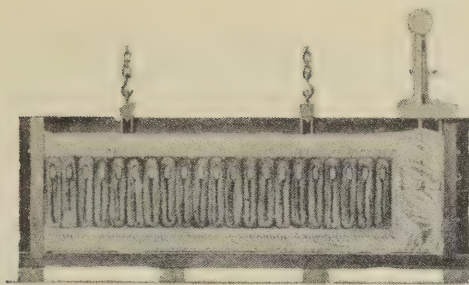
All dye should be dissolved in a pail or a barrel previous to being added to the kettle. With dyestuffs which do not dissolve readily the dye liquor should be strained on being added to the kettle and any residue reboiled until the dye has all been dissolved.

While the dye is being added to the kettle the propeller should be set in motion in order that the liquor be well stirred. During the dyeing the direction of rotation of the propeller should be changed at frequent, regular intervals. This prevents any dirt that may be present from being lodged in one end of the load, and also gives even penetration from both ends of the load. With the Hussong machine there is very small danger of unevenness if the dye has to be fed on or the shade built up by addition of color, because the load is lifted free of the liquor and the liquor can be well stirred before entering the yarn again. Care must be taken, however, that the additional color is not allowed to splash on the yarn as it is being added to the kettle, as this will result in spotting.

Shades which require a two-bath method or topping with basic colors are easily carried out in a Hussong machine with little danger of unevenness if



Battery of Hussong Skein Dyeing Machines



Section of Hussong Machine, Showing Circulation of Dye-Liquor Through the Yarn

the bath is well agitated upon the addition of each new dye. The bath strikes all parts of the load at the same time with the same degree of concentration, which is not true of other types of skein-dyeing machines. With the use of the machine as a standing bath for the production of the same shade on several successive loads of yarn the volume of water should be kept constant. Evaporation from the bath during the dyeing is offset by the condensation of the steam used in heating; but a considerable amount of liquor is carried out by each load of yarn, which must be added before the next lot is entered. A difference in the volume of the bath with different lots will cause a difference in shade, as with the addition of the same amount of dye each time the concentration becomes greater if less liquor is present, or less if more liquor is present. The more concentrated bath will give a heavier shade, and the more diluted the bath the lighter the shade. This is due to the exhaustive property of the dye. In dyeing the skeins the dye enters into the cotton until a certain degree of concentration is reached in the bath. Thus, if equal amounts of dye are placed in different quantities of water and the same amount of yarn dyed in each, there will exist in each bath about the same concentration of liquor after dyeing. However, one has more liquor and thus more dye, therefore leaving less dye deposited in the yarn than in the case of the shorter bath.

The Hussong machine is admirably suited for dyeing light tints in a cold bath, as the circulation of the liquor is obtained without having to turn on the steam to thoroughly mix the dye in the liquor. Often, with light colors and compound shades, the depth of color cannot be obtained unless steam is used to force the color on. This may cause unevenness, which the addition of about 2 per cent of soap at the beginning of the bath will generally prevent. If soap is used and the water is hard, about one-half of 1 per cent of soda will correct this hardness; but it must be added before the soap. Most heavy and medium shades can best be obtained at or just under a boil, with the addition of salt alone. With some dyestuffs 5 per cent of common salt will force on the dyestuff sufficiently; if more be used, the dye will jump on and give very uneven results. However, with other colors it may require 20 per cent or a little more to cause the color to go on, and there will be no unevenness.

With these things borne in mind, and with supervision by a careful operative, opportunity for unevenness due to the operation and care of the machine will be reduced to a minimum.

CARE OF SKEINS AFTER DYEING

In a few instances there is possibility of unevenness being caused by treatment, or more truly mistreatment, of the skeins after dyeing. The proper shade having been obtained, the load washed, softened or developed (whichever procedure is being used), the yarn should be headed off and extracted as quickly as possible. The extractor should be washed very clean after each shade, for many spotted goods are caused by lack of cleanliness in this respect. Yarn having been dyed with basic colors is very likely to leave stains on the extractor basket, and when extracting these yarns it is better to line the extractor with paper. Allowing light shades to lie around any length of time before extracting gives excellent opportunity for them to become spotted from brushing without rinsing. After being extracted the yarn should be dried as soon as possible. If allowed to wait until the outside of the truckload becomes air-dried there may, in some cases, result an unevenness when the yarn is dried. With the yarn dried the danger of causing unevenness is passed, and if it matches to sample after cooling and is even the dyer has won another round in the battle against unevenness.

On the whole, evenness in dyeing cotton skeins with the Hussong machine is dependent on proper preliminary treatment, proper loading of the machine, and a little care and watchfulness during the dyeing. These features count for the most and, if carefully looked after, excellent results will generally be obtained.

NEW BROWN RECORDING THERMOMETER OFFERED

The Brown Instrument Company, Wayne Junction, Philadelphia, is placing upon the market the new Brown Recording Thermometer, which, the company declares in its announcement to the trade, embodies novel constructional features which make it different from any technical instrument in its class.

Some of these are an adjustable pen arm, with set-screws for "set" and "tension," and an adjustable helix for calibrating. Every instrument is supplied with a moisture-proof case as standard equipment and at no additional cost. The automatic pen release lifts the pen automatically when the door is opened, while the patented chart clips automatically lock the chart when the door is closed. The Seth Thomas clock, eight-day movement, is attached to the front plate, insuring that the clock will at all times be in alignment with the chart, and the clock can be removed, if necessary for cleaning, in two minutes. The construction of the whole is sturdy and durable.

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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IRREFUTABLE EVIDENCE

THE article by Dr. Walter M. Scott, chief chemist of Cheney Bros., which appears elsewhere in this section together with the accompanying table of German dyestuffs and American equivalents which have been utilized by this firm, should be of great interest to those American textile manufacturers who have contended that they found it impossible, or at any rate extremely difficult, to do without German colors.

Since the table in question was prepared, we are advised by Dr. Scott that he has received samples of two additional colors now being placed on the market by American manufacturers which appear to be fully equal to pre-war types and take the place of colors which he listed as being without satisfactory American-made substitutes—the two colors in question being Benzo Fast Black L and Benzo Fast Orange S. With these additions, an examination of the table will show that of the twenty-nine standard pre-war colors which Cheney Bros. found it necessary to use in producing their wide range of fabrics, twenty are now made in this country, two imported from Switzerland and, of the nine remaining colors not being made in the United States, equally satisfactory substitutes have been produced for four, leaving only five, or approximately 17 per cent, which American dyestuff manufacturers have not as yet been able to supply.

In a letter received from Dr. Scott subsequent to the preparation of his article he gives us figures based on the total consumption in pounds rather than the number of varieties, which are even more convincing. It appears that for the calendar year 1913 the dyestuff consumption of his firm was 91.9 per cent German colors and 8.1 per cent American; in 1919 the ratio was 18.1 per cent German, 3.7 per cent Swiss, and 78.2 American, while in 1920 it was 6.2 per cent German, 5.4 per cent Swiss, and 88.4 per cent American. In other words, at the close of

1920 only 11.6 per cent of the total dyestuff consumption of his firm was of other than American manufacture and, according to Dr. Scott, this percentage is steadily decreasing.

That the very nearly exclusive use of American colors did not in any way hamper the extent or variety of fabric production by this firm was amply demonstrated at the recent Silk Exposition at the Grand Central Palace, where Cheney Bros. exhibited what was easily the most varied and colorful display of the brilliant collections there shown, including as it did practically every variety of silk fabric from the most elaborate draperies and decorative silks to staple dress goods.

Such a showing as that made by Cheney Bros. should go a long way in rebuttal of the complaints occasionally voiced by some of our textile manufacturers who profess to be unable to do without foreign-made colors. It would seem obvious that these complaints must arise from one of two principal causes—either the complainant, for reasons best known to himself, does not wish to see the American dyestuff manufacturing industry prosper or he has been unwilling to take the trouble to find out for himself what extremely satisfactory results can be obtained by the use of American colors.

HOW GERMANY DOES IT

IT goes without saying that renewed German control of American dyestuff markets would strike a decided blow not only at our own dye industry—which would be destroyed—and this country's defenses against possible foreign aggression, but at the consumers of dyes as well. Nevertheless there are still many of the latter who mistakenly believe that domination by a German trust is preferable to competitive service from a large number of American manufacturers—though why they think so, no one knows—but in order to bring this about while at the same time preserving their reputations for patriotism they mask their inner motives behind an apparent friendliness to the dye industry and attempt to confuse the issue by suggesting that with the same brand of protection accorded any other industry, no matter how long established or powerful it may have become, our dye industry will be able to hold off the German assault. Very strong efforts are still being made to talk Congress into sharing this belief.

A recent and highly illuminating incident having to do with the sale of a number of German locomotives in Spain, while applying only indirectly to the case in point, yet serves well to show us just what kind of competition our infant and unorganized dye industry would have to meet—and shows, too, the sheer idiocy of permitting the dissolution of the War Trade Board by declaration of peace without first guaranteeing that the dye industry will not have to cope single-handed with the German commercial machine.

When it was announced that the Spanish Government had awarded to German firms the contract for furnishing sixty locomotives to the Northern Railway Company of that country, it soon became apparent that price was not

the only consideration and that, as a matter of fact, the bids of several competitors were actually slightly under those made by the Germans. The Societe Franco-Belge de Materiel de Chemins de Fer, for instance, offered twenty-five locomotives, the price being 7.51 francs per kilo for the locomotives and 4.40 for the tenders, these figures, at the prevailing exchange, being equivalent to 4.05 and 2.59 pesetas respectively. The German prices varied between 4.40 and 3.75 pesetas for the locomotives and 3 and 2.50 for the tenders.

The Germans obtained preference by guaranteeing early deliveries for the most important lots. One English firm offered the same advantages, but its prices were higher. Sixteen German firms, however, collaborated, and six or seven of them figured as guarantors. Furthermore, the German Government gave its aid in assuming responsibility for any forfeit that might become due for delay in filling the contract.

Now, under the Edge law, American firms can get together in quite as effective a manner for the purpose of holding their own in world markets, but when it comes to selling the American consumer they would very quickly find themselves running afoul of the Sherman law if they attempted to pool their interests. But the Germans can do just that very thing when they get ready to come after American trade, and moreover in the case of the dye industry we should see one of the weakest of American industries trying to contend with the largest, strongest and most closely-knit industrial organization in all Germany—the I. G.

Aside from the other insurmountable obstacles represented by appalling differences in exchange rates, labor costs and experience, would it not in any case be asking for a miracle to suggest that a large number of unrelated American firms could compete with a giant trust?

And in addition, it must always be remembered that hitherto Germany has not only been unable to make a bid for her old place in American dye markets, but that since imports have been under the control of the War Trade Board and the question of future protection is being debated, she has striven in every way possible to minimize (publicly) her industrial prowess in this special field with the idea of nurturing just such beliefs as are held by objectors to the licensing system.

Germany has not as yet been able to make her bid for American dye markets, but business men, no matter in what line, do not need many illustrations like the foregoing in order to appreciate how well she is equipped to make that bid irresistible if the proper time ever comes.

And the arrival of the proper time would be signaled by the failure of Congress to do something decisive in the way of protecting the dye industry before passing any peace resolutions.

"SAFE, SANE AND INEXPENSIVE"

DESPITE the really astonishing quantity of sound fact and expert testimony which has been laid before all elements of both dye making and dye consuming industries during the past two years, and the great gain

in public knowledge of the issues at stake in the controversy over methods for the protection of the dye industry, there remain a few individuals and firms which, in good faith and from motives which are beyond question, persist in preaching the doctrine that a tariff alone will be sufficient in the way of a bulwark to withstand the forthcoming German assault.

Once upon a time this conclusion might have been the correct one; in the years to come it will again be safe to act upon. But at present it can only be arrived at by refusing to take cognizance of the truth that commercial relations as between one nation and another are absolutely unique, and that the question of the dye industry stands alone even amid this uniqueness. Its claim to immediate consideration is a double one, either portion of which entitles it to take precedence over all other industries; since, if one considers it from the standpoint of its value to the country, he is forced to recognize its fundamental role in placing us on a level or above other nations in armament, while if it be viewed as one of a number of American industries which on general principles we are bound to protect and foster, the overwhelming power of its foreign competition cannot escape attention.

The REPORTER maintains that both of these propositions are in accord with the wishes of a majority of the people: That we must be adequately armed, and that we must encourage every American manufacture.

It is significant that, in all the time since the subject was first agitated, however heated the innumerable discussions may have waxed, no one has been bold enough to assert that we do not need a dye industry. The sole source of contention has been the choice of a method for preserving it, many favoring the license system and some insisting that a special tariff will suffice. Those who have upheld the latter course, with the exception of expert lobbyists and politicians masking their activities in behalf of the Cartel under a cloak of plausible friendship for the textile people, honestly believe their arguments to be sound, and it is to these that we would again address a brief word on the role of present and future exchange values in this situation.

While the value of the mark has shrunk somewhat in Germany, it remains, to all intents and purposes, a mark, and it does not take so very many more of these marks to pay the wages of dye workers and chemists than it did before the war. The shrinkage of the mark in Germany is in no way comparable to its shrinkage in this country, where it is now worth less than one and one-half cents. On the face of this, the imposition of any sort of a duty based on the money value of German imports, with the idea of placing German factories on an even footing with American, becomes an absurdly fruitless proceeding.

Only specific duties could avail, and should they be resorted to, they would have to be so immense that immediately we should be faced with another difficulty, namely: In what way would this benefit the American dye consumer, in whose interests (?) so many advance the tariff argument?

Indeed, it is apparent that such protection would leave

him no better off than before; that, in fact, it would be positively detrimental to his peace of mind and the state of his pocketbook.

If the American dye manufacturers are really the rapacious lot which opponents of the Dye bill declare them to be, seeking only to get control of our dye markets in order to milk the consumer to the ultimate cent, the effect of such duties would be to enable them to raise present prices to a point just short of German prices plus duty, and thereby create what would virtually be a combine out of a large number of American factories now competing among themselves.

On the other hand, the licensing system would promote healthy competition at home, would enable American consumers to purchase freely abroad what they cannot get here, and, most important, would enable them to purchase foreign colors more cheaply than they could under a tariff which had been heightened sufficiently to overcome the difference in monetary values.

Most American consumers, anxious to see the American dye manufacturers prosper, and to buy from them whenever possible, would not hesitate very long when offered their choice between paying a ruinous duty with the privilege of importing any color which fancy dictated, and paying a merely nominal duty on colors not yet produced by Americans.

Uneven Piece Dyeing of Woolens and Worsteds—Part I

A Synopsis of the Causes Leading to Unsatisfactory Results in the Dyeing of Woolen Piece Goods, with Suggestions for Overcoming These Difficulties

By R. R. SLEEPER

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IT is a generally recognized fact that for the production of solid shade effects the most economical method of color application is to the woven material, rather than to the yarn or loose stock

Application of color to the piece is considered the most economical method owing to the elimination to a great extent of the waste, which results when colored stock passes through the operations preliminary to finishing, due to possible felted condition of the loose stock or yarn and tangled or broken threads; the latter trouble being principally due to a weakening or unintelligent handling of the yarn. Furthermore, certain operations such as preparation of skeins, rewinding operations and extra handling are necessary when working dyed stock or yarn, which is not the case when piece dyeing is resorted to.

When handling material which is to be piece dyed, all operations are carried out with stock, which at the most has only been subjected to scouring and carbonizing previous to carding; and which has not become felted or weakened due to extra handling or dyeing.

Practically all solid shade effect suitings or dress goods

material, which has been stock or yarn dyed is subjected to a mild scouring and, in many instances, a milling, crabbing and blow steaming following the weaving operation which necessitates the application of coloring matters, which will withstand such treatments. Material which is to be dyed is, as a rule, subjected to such treatments while in the undyed woven state and it is not therefore necessary to apply dyestuffs which will withstand the color destroying action of these treatments.

The obtainance of satisfactory results by piece dyeing may appear to the yarn or raw stock dyer a comparatively simple operation, but when it is taken into consideration that the goods have passed through many operations previous to their arrival at the dyeing department, the opportunities for the deposition of foreign substances which might possibly interfere with the uniform absorption of dyestuff are very great. It is practically impossible in many instances for the dyer to determine whether the pieces are in proper condition for the uniform absorption of dyestuff and he is therefore dependable to a great extent upon the intelligent handling of the goods, while they are passing through previous operations.

The finishing and dyeing operations are as closely allied as any two operations through which the goods pass and for production of satisfactory results and the eliminating of "seconds," the supervisors of these two operations should at all times work in harmony.

It will be readily admitted by those familiar with the handling of piece goods, that uneven shade effects result not only from irregularities in the application of the dyestuff, but frequently through the ignorant or careless handling of the pieces as they pass through the finishing operations, either previous to, or following the dyeing operations. If such results are due to faulty finishing or to causes other than dyeing, the dyer is usually compelled to assume all blame unless he is sufficiently familiar with the treatments to which the goods are subjected to recognize the cause of faulty work.

Causes for uneven piece dyes may be subdivided under two general headings:

First—Those for which the dyer should be held responsible.

Second—Those for which the supervisors of other departments should be held responsible.

Under the first division a few of the many causes will be briefly discussed.

INCOMPLETE WETTING-OUT OF THE PIECES PREVIOUS TO DYEING

Danger from this source is eliminated providing the pieces arrive at the dye house in a well wet-out condition and are not allowed to become partially dried out.

Insufficient wetting-out of the pieces previous to the addition of the dyestuff will result in the absorption of dyestuff by those portions of the material which are thoroughly wet-out and is very apt to result in the production of dark colored portions as compared with the remain-

ing portions which do not absorb the dyestuff as readily until they become thoroughly wet-out.

INCOMPLETE SOLUTION OF THE DYESTUFF

Dyestuffs vary in their solubility. Some are readily soluble in water; some difficultly soluble and a few, as for example, Alizarine Paste, are insoluble. It is with those which are somewhat difficult to dissolve that special precautions should be taken. In any case when using soluble dyestuffs, their solutions should be carefully strained before introducing into the bath, as a preventive to the introduction of small particles of undissolved dyestuff, which are very liable to adhere to the goods and thus cause specky shades.

SPATTERING OF THE ACID UPON THE CLOTH WHEN INTRODUCING IT TO THE DYE BATH

It is a frequent custom to introduce the diluted acid to the bath while the machine is in motion. It is usually "fed" in by the use of a pail or dipper and if care is not taken operators are liable to become careless and cause more or less of the acid solution to come in direct contact with the cloth. This will result in a rapid absorption of the dyestuff by those portions of the cloth which are more strongly acid and thus result in the production of cloudy shades.

TOO SHORT A BATH OR CLOUDING THE KETTLE

The temptation arises at times to increase the output by attempting to obtain satisfactory results by overloading the kettle.

By so doing the proper circulation of the pieces through the liquor is prevented. The pieces become so packed together that it is practically impossible for the dye liquor to uniformly come in contact with the pieces or to allow a uniform distribution of the heat. Such conditions will most assuredly result in a lessening of the output, due to an increase in the number of unsatisfactorily dyed pieces.

IMPROPER METHOD OF APPLICATION

The method of application depends to a great extent upon the affinity which the dyestuff has for the fiber and to the type of fabric being handled.

If a so-called level dyeing color is being employed a more active acid may be used with less danger of a rapid and uneven absorption of the dyestuff resulting, than if a dyestuff of different properties was used.

Closely woven or heavily felted goods are somewhat difficult to penetrate with coloring matters and therefore special precautions are necessary when handling such types of fabrics.

The following assistants are used with the so-called acid colors for the acidifying of the dye liquor: Sulphuric Acid, Sodium Bisulphate, Acetic Acid, Formic Acid, Ammonium Acetate and Ammonium Sulphate.

Sulphuric Acid is the most active of the above mentioned assistants and if employed one should be familiar with the exhaustion properties of the dyestuffs which are being used. Its tendency with many dyestuffs is to cause a rapid absorption of the color, and if precautions are not taken, uneven and poorly penetrated dyeings will result.

Sodium Bisulphate acts in a similar manner as does Sulphuric Acid, but its tendency to cause rapid exhaustion is not as great. When first added to the dye liquor its acidifying action is very slight, but as the temperature of the liquor rises a decomposition of the assistant takes place, resulting in a liberation of free Sulphuric Acid. Tendency towards uneven dyeings is not so great as when Sulphuric Acid is employed, but its action is very similar.

Formic Acid is somewhat milder in its action than is Sulphuric Acid or Sodium Bisulphate and if unsatisfactory dyeings result with these reagents, it is quite possible that by the use of Formic Acid, more satisfactory results will be obtained.

Acetic Acid is comparatively mild in its action and use is made of its property when applying dyestuffs which have a tendency to produce unsatisfactory results when Sulphuric Acid is used. A very common procedure is to make an addition of Acetic Acid to the dye liquor at the commencement of the dyeing operation and after forty-five minutes boiling, to add a small percentage of Sulphuric Acid and thereby complete the exhaustion of the dye liquor.

Ammonium Acetate or Sulphate are used with dyestuffs which have a tendency to be absorbed very rapidly and completely and where, if applied with assistants of a more strongly acid nature, uneven and poorly penetrated dyeings would result.

It is a common practice to make an addition of a small percentage of Acetic Acid to the dye liquor to complete exhaustion after about forty-five minutes of boiling.

When applying the true mordant colors, as, for example, Alizarine, which are applied in a neutral or mildly acid solution, special care must be taken to start the dyeing operation practically cold and not to raise the temperature of the dye liquor to a boil in less than forty-five minutes' time.

FEEDING ON OR SHADING AT TOO HIGH A TEMPERATURE

It is oftentimes necessary to make an addition of dyestuff to the dye liquor after the dyeing has been progressing for some time, for the purpose of toning up the shade. If such an addition is deemed advisable, special care should be taken as to the nature or properties of the dyestuff to be selected for this purpose.

Only dyestuffs which have the property of slow and uniform dyeing should be used and not those which have a tendency to be rapidly absorbed, otherwise the dyestuff used will be absorbed unevenly and will not penetrate the fabric. The safest procedure is to allow the dye liquor to cool down somewhat before making any additions of coloring matter.

(To be concluded.)

A BRIEF RESUME OF WRITING AND PRINTING INKS

By Walter E. Hadley

(Concluded from last month.)

COPYING INKS

Inks which are to be used for copying purposes may be prepared according to the recipes used for the regular writing inks, except that certain hygroscopic bodies such as sugar, dextrine, glycerine, etc., should be added thereto which will keep the ink moist after writing.

Inks containing a precipitate held in suspension by gums are less suitable for copying purposes than those which contain no precipitate, inasmuch as the former would remain upon the surface of the paper and might yield one good copy, whereas the latter, in penetrating the paper and oxidizing slowly, would give a number of copies.

PRINTING INKS

From a chemical point of view, printing inks are in reality quick drying paints. They are made up with different colored pigments, thoroughly mixed with varnish, prepared from boiled linseed oil, rosin oil, or similar substances used in the preparation of paints.

BLACK PRINTING INKS

The base of black printing inks is a very fine grade

of lampblack which is incorporated with a varnish. The amount and quality of the pigment vary greatly, depending upon the type of work for which the ink is to be used.

As low as 20 per cent and as high as 40 per cent of lampblack is used. At times a small amount of blue pigment is added to impart a blue cast to the ink.

NEWSPAPER INK

Newspaper ink does not require to be of such expensive character as ink used for better quality work. It is largely prepared from lampblack and heavy mineral oils, these latter oils having to a large extent replaced rosin oils, which were formerly much used. Soap is often incorporated with printing ink, as it aids in the application of the ink. Printing inks are made either thick or thin, depending upon whether same are to be used for slow or fast printing.

COLORING PRINTING INKS

Colored printing inks are prepared by incorporating colored pigments with heater oil, such pigments as the following being representative of the types used:

Red—Vermilion, Madder, Indian Red, Burnt Sienna, Red Lead, etc.

Blue—Ultramarine, Prussian Blue, Chinese Blue and Indigo.

Yellow—Chrome Yellow, Yellow Ochre, etc.

Various hues and casts can be obtained by the proper mixing of red, blue and yellow pigments.

Simple Tests for Proofing the Value of Aniline Oil

By RAFFAELE SANSONE

(All rights reserved.)

OWING to the different qualities of aniline oil offered on the market, its testing requires special care, and the number of trials carried out in the laboratory should be regulated in accordance with its employment, or scope, in the different works, where it may be destined for dyeing and printing purposes, or for the production of artificial coloring matters, or special synthetic products, such as paranitraniline, etc.

TESTS FOR DYE WORKS

When aniline oil is employed in the dye works, it may often be of specially chosen quality, being destined to the production of a special class of aniline black. For this reason an aniline oil containing a certain percentage of ortho and para toluidine may be preferred in some cases to a pure aniline oil, owing to its greater facility of forming an ungreenable aniline black, and may have to be obtained through mixing the crude market product with pure aniline or, on the contrary, the crude product may be used in preference to all others. This when aniline salt is not used.

In all cases, however, the work of the chemist can be much simplified if he fixes as a starting point a works standard for the oil, or aniline salt, and tests all new deliveries or products offered against this standard under exactly the same conditions in all cases, limiting his work to a few carefully chosen trials, or tests, that he carries out with the greatest accuracy and methodicity.

FIRST DYEINGS OF ANILINE BLACK

When aniline black is dyed for the first time the choice of the most suitable product for the requirements of the works is no easy task, and requires a certain amount of experimenting on both a small and a large scale. The manufacturer in such cases generally fixes the type of aniline black he wants to produce, arranging for the same in the works the necessary plant, but before he obtains exactly what he wants the colorist has to produce first in his laboratory on small samples the desired shade of black, and has to prove that the recipe used does not

bring more than a certain tendering. Before he can reach this point he has, however, to fix in his mind the particular aniline oil or aniline salt which he needs for the trials. Once he has accomplished this, and the experiments in the laboratory have been conducted to a satisfactory conclusion, he assists in the works in the application of the process on a large scale. Here whole batches of goods are often tendered if the necessary care and precautions are not taken in the preparation of the baths of treatment, or if the black is not developed and fixed with the most convenient means, and in the most satisfactory way. A fixed, or standard, product should never be given up until, through practical trials in the works, it has been proved advisable to substitute it with a better or more convenient product.

NATURE OF TRIALS FOR DETERMINING THE VALUE OF ANILINE OIL

Among the different trials proposed, the following will be found to answer most purposes, and will also satisfy the foreman dyer or printer, thus avoiding the entrance into the dye works or print works of products that are not exactly equal to preceding deliveries, or to the product adopted as works standard. By utilizing these tests the production of unsatisfactory blacks on a large scale which might follow the use of inferior aniline oil with consequent differences in shade, less resistance to greening, etc., may be avoided. The different trials at the disposal of the colorist for determining the value of an aniline oil, or aniline salt, are of analytical and practical nature. The analytical tests comprise:

1. The determination of the specific gravity of the aniline oil.
2. The determination of the boiling point and percentage of pure aniline oil.
3. The coloration test with hypochlorite of soda.
4. The determination of percentage of non-basic substances.
5. The determination of moisture.
6. The detection and determination of sulphur, etc.

The Specific Gravity Determination.—The determination of the specific gravity of an aniline oil is quite a simple operation. When a hydrostatic balance is not at disposal a small flask densimeter and any balance accurate to decimals of milligrams will be quite sufficient for satisfying most requirements. A very useful form of densimeter, which should, however, be carefully cleaned after each determination with strong hydrochloric acid, being completely freed of this after the cleaning, consists of a small round flask, closed through a glass stopper having in the center a small hole, running down its whole height. This flask contains exactly 100 grams of water, and its weight when completely filled with aniline oil, divided by 100, gives at once the specific gravity of the latter. The determination takes but a few minutes. By knowing the specific gravity of the works standard it is then seen at once if there is a difference

between a new delivery and an old one, or between a new product just being offered and the works standard, that can bring a doubt on the value of the same.

Boiling Point and Pure Aniline Determination.—The following trial is often carried out for determining simultaneously the boiling point and the pure aniline content of a new sample in comparison with a works standard: Place in a small, thin glass retort, closed by a rubber stopper supporting a thermometer, 100 cubic centimeters of aniline oil, so that the bulb of the thermometer lies in the liquid, and heat carefully over a Bunsen burner. The tube of the retort is connected with a condenser, and the distillate is allowed to drop into a graduated 100 cubic centimeters glass cylinder until a temperature of 182 deg. Cent. has been reached. After this another graduated cylinder is substituted for the first and all liquid is collected up to 184 deg. Cent. This constitutes the pure aniline.

Coloration Test with Hypochlorites.—This test may be used for giving an approximate idea of the coloring strength of an aniline oil. For this purpose exactly one gram of the works standard and one gram of the aniline oil under investigation are added separately to two lots of 1,000 cubic centimeters of distilled water, containing a fixed quantity of fresh hypochlorite of soda and contained in two long glass cylinders closed by glass stoppers. After agitating well and allowing to stand for some time both solutions are examined for noting any difference in the intensity of the violet coloration produced. If the test is properly conducted it is thus possible to see in a very short time if one aniline is stronger than the other.

Determination of Non-Basic Substances.—The determination of the non-basic substances offers no great difficulty. The test is carried out by treating ten cubic centimeters of the aniline oil with fifty cubic centimeters of water and forty cubic centimeters of hydrochloric acid. When no non-basic substances are present a completely limpid solution should be produced. Any turbidity or separated matter indicates the presence of hydrocarbons and of nitrobenzene.

Moisture Determination.—One hundred cubic centimeters of aniline oil are distilled as already indicated in the case of the pure aniline determination, and the first ten cubic centimeters that come off are placed in a graduated cylinder of fifteen cubic centimeters capacity, being then agitated with one cubic centimeter of a saturated salt solution. The diminution of volume shown indicates the quantity of water present.

Determination of Sulphur.—One hundred cubic centimeters of the aniline oil are boiled for some time under a reflex condenser for transforming any sulphur that may be present into sulphuretted hydrogen. A stream of carbonic acid is then caused to pass first through the boiled aniline, and then through a normal solution of nitrate of silver. If a black precipitate is produced this indicates that the aniline oil contained sulphur, and its quantity can be determined from the quantity of silver solution consumed, or precipitated.

THE PRACTICAL TRIALS

The practical trials are of great value, and should be modified so as to imitate on a small scale the same process for dyeing as is used in the works. When the aniline oil is to be used in the works for the dyeing of one bath aniline black, the following small dye trial will often be found useful, owing to its great simplicity: Two samples of exactly 100 grams each of dry gray cloth, free from size, are carefully weighed out, the one being marked with one hole and the other with two. When this has been accomplished, exactly ten grams of the standard aniline oil and of the aniline oil under investigation are weighed out separately, and are each mixed in different beakers with fifteen grams of hydrochloric acid and 100 grams of water, forming a cold, clear solution, to which are then added twelve grams of bichromate of soda dissolved in 100 grams of water. To the bath containing the works standard is added the sample marked with one hole, and to that containing the aniline oil under investigation is added the sample with two holes. The two samples are then stirred for exactly one hour, and then left to soak overnight, or brought slowly to the boil, in accordance with the process used in the works. In both cases the two samples are rinsed after the dyeing process in separate waters, and are soaped at the boil in separate baths, containing ten grams of soap dissolved in 200 cubic centimeters of water. After the soaping, and a second rinsing, the two samples can be dried and compared, noting if there is a difference in shade. If exactly the same shade is produced in both cases, the two aniline oils can be considered as being of equal strength. Their fastness to weak acids is next tested (the greening test), to bleaching powder, etc. Should cases arise where the black obtained with the new aniline oil is not as good as that obtained with the works standard, the test is repeated with another sample, if this is available, and if the same result is obtained the new oil can be condemned straightway. In this case a difference should also have been noted during the preceding analysis of the oil.

LONG PROCESS ANILINE BLACK

The following trial may be useful in those cases where the long process aniline black is dyed in the works:

Sixty parts of the standard aniline oil, and sixty parts of the aniline oil under investigation are mixed separately with sixty parts of hydrochloric acid, and to each of the resulting mixtures a solution is added containing ten parts of tartaric acid and sixteen parts of chloride of ammonia, dissolved in 400 parts of water.

The cold solutions thus produced are then added to two other solutions containing each exactly twenty-five parts of chlorate of potash and eighteen parts of sulphate of copper, dissolved in 400 parts of water at the boil, and then cooled.

In the two baths thus produced separate samples of exactly 200 grams of dry gray cloth, that has been prop-

erly freed of all size or filling, are wetted, being then squeezed in a fully spread condition between the nip of a clean pair of india rubber squeezing rollers, and then hung in an atmosphere at a temperature ranging from 40 to 50 deg. Cent. till a deep green color is obtained. The intensity of the green color thus produced will often be a good indication of the strength of the new aniline oil in comparison with the works standard. At this point both samples are chromed in a bath containing six grams of bichromate of soda and two grams of sulphuric acid in every 100 grams, or cubic centimeters, of water.

PRUSSIAN ANILINE BLACK

When prussian aniline black is being produced in the works, the following trial is useful in some cases: Make two solutions by dissolving six parts of chlorate of potash and eight parts of yellow prussiate in 100 parts of water. Cool after this and add to one of the baths six parts of the works standard aniline oil, dissolved in six parts of hydrochloric acid and ten parts of water, and to the other solution add a solution containing six parts of the new aniline oil under investigation, six parts of hydrochloric acid and ten parts of water.

A sample of gray cloth of twenty grams is impregnated in each bath, and then passed between a pair of clean squeezing rollers, dried and steamed for forty-five minutes, and chromed in a bath containing 2 per cent of bichromate of soda, on the weight of the material, at the boil. The chroming is followed up by a soaping and rinsing, after which the sample is dried. If everything is carried out with the greatest exactitude and care, and both samples are treated under exactly the same conditions, the above test can be of great value, showing exactly the strength of each product.

ANILINE SALT

When the value of aniline salt is proofed against a works standard 100 grams of both products are dissolved in the same volume of hot water, and the resulting solutions are poured in very high glass cylinders, graduated to cubic centimeters, where they are decomposed with caustic soda, adding enough common salt to make a saturated solution. The aniline oil thus collects in both cases at the top of the water solution, and its volume can be measured at once, showing if the new product is as strong as the older, or standard aniline salt. A larger quantity of the standard and new aniline salt are then submitted to the same decomposition operations, and the resulting aniline oil is submitted to all the chemical tests already indicated. Besides this, water solutions of the standard and new aniline salts are often comparatively titrated with a normal caustic soda solution. The practical trials carried out in this instance would be of a nature analogous to those already indicated for aniline oil, and the same recipes given could be used by substituting the aniline oil in the same by the corresponding quantity of aniline salt.



MEN OF MARK in the DYESTUFF FIELD

Elvin H. Killheffer

Vice-President in Charge of Sales

Newport Chemical Works, Inc.

Passaic, N. J.

ELVIN H. KILLHEFFER was born January 16, 1884, at Millerville, Lancaster County, Pennsylvania. When six years of age his parents moved to Philadelphia, in the schools of which city he received his early education. While attending high school he developed an interest in chemistry, which led him to secure employment outside of school hours with Shoemaker & Bush, a manufacturing drug concern. Upon leaving high school he entered the Philadelphia Textile School and, after graduating from this institution, was employed for a time in the chemical laboratories of the Southwark and Sauquoit Silk Mills, whence he went to the New York office of Kalle & Co. as a service chemist and where, in a short time, he became chief chemist. He was subsequently sent by Kalle & Co. to their plant at Biebrich-on-Rhine, Germany, where he acquired an intimate knowledge of dyestuff manufacturing problems. Upon his return to America he acted as a dyestuff application expert for this firm, visiting those of their customers throughout the country who had difficult problems to solve, and in this way obtained an insight into the consumers' side of the dyestuff business.

Soon after the outbreak of the World War, a concern known as the Orient Trading Company was formed by interests connected with the silk industry of Paterson for the purpose of purchasing, for import into the United States from China and Japan, stocks of German dyestuffs known to be available in those countries. The chief problem which confronted this company was to find a man possessed of the qualifications necessary to enable him to act as purchasing agent for them in the Orient. Mr. Killheffer was finally selected for this most important task because of his intimate knowledge of dyestuff values, both from a chemical and a monetary standpoint, his forceful personality and his ability as a shrewd buyer. The successful results of this venture are now well known in dyestuff circles. The colors which he was able to secure for shipment to this country were badly needed at the time and were of great assistance to American dyestuff consuming industries.

Upon his return to America he started in the dyestuff manufacturing business at Passaic, N. J., under the name of The American Color Manufacturing Company. This concern successfully produced over a dozen colors, among them Chrysophenine, which was at that time particularly wanted and not elsewhere available.

At the conclusion of the war he effected an arrangement with the Newport Chemical Works, Inc., whereby they absorbed the American Color Manufacturing Company, and he became vice-president of the former concern, which office he still holds. In this capacity his thorough technical knowledge of dyestuffs from both manufacturing and application standpoints and his all-around business ability have been of material assistance in putting the Newport colors where they are to-day.

At the present time he is traveling in China and Japan with the purpose of establishing permanent offices for the Newport Chemical Works, Inc., in the Orient and otherwise developing their Far Eastern business.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the **AMERICAN DYESTUFF REPORTER** by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

H. F. M.—Question: Can you give us any information relative to dyeing artificial silk in the raw, that is, before it is thrown, in such a way that it will be easily wound afterward? We can dye it easily, but have trouble in winding it after it is dyed.

Answer: In order to dye artificial silk in the raw—that is, in skeins of the fiber before twisted or spun—and obtain satisfactory results, two essential precautions are necessary. First, the stock should be dyed with colors which will dye cold or warm; that is, the bath should, under no circumstances, be made hot enough so that it will boil or be in agitation; second, immediately after rinsing, the skein should be stretched or at least straightened out and allowed to dry in a straightened condition.

Direct cotton colors and some others will dye artificial silk satisfactorily in a temperature not exceeding 150 deg. Fahr. Because of the peculiar nature of this fiber, if there are any kinks in it when it dries these kinks are practically impossible to remove afterwards and will seriously interfere with any throwing operation. In order to avoid this the skeins must be stretched, or at least straightened out, immediately after rinsing and allowed to dry in this form.

S. W. M. Co.—Question: Will you please advise through your paper the best method for dyeing noils and wool that have been carbonized with the aluminum process? We have quite a great deal of trouble here at times in getting our colors right on wools that have been carbonized with this process. The colors do not seem to be bright. In having wool carbonized would it not be well to have it done by the acid process? Any and all information you can give will certainly be appreciated.

Answer: The aluminum carbonization process almost always gives trouble and we would suggest that the material which has been treated with this process be washed in a bath made slightly acid with dilute sulphuric acid and afterward rinsed very thoroughly.

If this treatment does not improve the results you are obtaining we suggest that you change to the acid process of carbonization which is much more uniform. If you have been doing your own carbonization by the aluminum process you ought to make sure that the wool and

noils are perfectly clean before they are saturated with the aluminum chloride.

D. M. Co.—Question: We would appreciate your advising us of the names of the concerns in the United States who are making Naphtol Green B—Schultz No. 4.

Answer: This product is made by John Campbell & Co., 75 Hudson Street, New York City; also Dye Products & Chemical Company, Inc., 200 Fifth Avenue, New York City, and possibly by others of whom we have no record.

E. W. R.—Question: Is there any advantage in boiling out cotton yarn before dyeing and, if so, why does it benefit it more than dyeing in a boiling bath?

Answer: A simple laboratory test will show that a fuller and brighter shade may be obtained with the same amount of dyestuff, if the yarn has previously been boiled out in soda solution. This is probably due to the fact that the alkaline bath removes the waxy and resinous matters from the fiber and allows of more intimate union between fiber and dye, with the result that each fiber is penetrated more fully and takes up more color than when the resisting materials are still present. The simple boiling dye bath is not sufficiently alkaline and, if it were the shade would be still lighter as the conditions are not favorable for complete exhaust of a direct dyestuff (except in a few special cases). The addition of about 2 per cent of soluble oil to the dye bath makes it capable of penetrating the waxy matter so that the result is probably as good as a preliminary boil-off.

J. B.—Question: I am a silk dyer and am sending you a sample of a green olive oil soap which I have been using and which is supposed to be a neutral soap. It does not work right and I think it has a lot of free alkali in it. I would thank you to analyze it and let me know the excess of alkali which it contains.

Answer: An analysis of the bar of soap which you submitted would seem to show that it is not because of any free alkali contained therein that you may have had difficulties with in its use. Apparently the soap is of good construction and reasonably pure and should give the same results as any other well manufactured soap if used under proper conditions. It is true that the free alkali is somewhat higher than in same brands of soap which we could recommend to your attention but we doubt if this would be sufficient to cause the trouble you mention. A brief analysis of the soap follows:

Water	26.45 per cent
Anhydrous soap	73.15 per cent
Fatty acids	65.51 per cent
Combined alkali	7.05 per cent
Sodium carbonate	0.20 per cent
Impurities	0.18 per cent
Free alkali	0.21 per cent

Review of Recent Literature

A Text-Book of Dye Chemistry. G. von Georgievics and E. Grandmougin; London; Scott, Greenwood & Son.

Translated and revised from the fourth German edition by F. A. Mason, this work on the chemistry of dyestuffs has been published with the aim of meeting the requirements of those whose lack of familiarity with the German language may render the reading of the original a tedious business. The translation in question is entirely new, and in carrying it out, advantage has been taken of the opportunity to bring the subject matter up to date, as well as to make alterations to the original text where changes seemed desirable. References to works published during the period from 1913 to 1920 have been inserted, and in the majority of cases the British patents have been cited as well as the German.

The book in its entirety is concerned solely with the chemistry of dyestuffs and is intended for the use of color chemists. Following an introduction which deals with the classification and general characteristics of dyes, two separate chapters are devoted to a consideration of coal tar and intermediate products for the manufacture of dyes. The separate sections include: Nitroso, nitro, azo, and diphenylmethane dyes, ketonimines, triphenylmethane, xanthene, quinoline, anthraquinone, hydroxyketone, and xanthene dyes, flavones, naphthazarine group quinoneimine dyes, acridines, indigo, indigoid vat dyes and anthraquinone vat dyes, sulphur dyes, murexide, natural coloring matters (including dyes of animal origin and dyes of vegetable origin and mineral colors). A bibliography of the literature of the dye industry is included, as well as a comprehensive twelve-page index. The work should be extremely useful to dye and color chemists.

Benzol—Its Recovery, Rectification and Uses. S. E. Whitehead; 209 pages; 196 illustrations. London, Benn Brothers, Ltd. New York, D. Van Nostrand & Co.

The recent high demand led to the stimulation of the collection of benzol from all sources, and as a result, every possibility in the way of an industrial process was subjected to close scrutiny and the practice of extracting benzol from coal gas was undertaken in all gas works of any size. The present work compiles and condenses much of the new information gained in England and elsewhere during this period, and is a valuable record of scientific achievement and data reduced to book form. The author is to be commended for the number of illustrations introduced, as well as for their character, for they are of the type which actually assists the intensive reader.

The book is divided into three general sections, dealing with: The Recovery of Benzol from Gas; the Rectification of Benzol, and Uses of Benzol and Its Products. An

appendix gives sound information on the analysis of crude benzol. Practical considerations receive very detailed treatment. Theoretical complications are not avoided, but the work is primarily designed as an industrial effort of the highest type rather than as a special chemical treatment of the hydrocarbons. The book can be recommended to all who are directly concerned with or interested in the subject covered.

Textile Calculations. J. H. Whitwam; London, Sir Isaac Pitman & Sons, Ltd.

On account of its high prices (25s.) it may be that this work is beyond the reach of many students who would greatly benefit from a study of it; nevertheless it will be found very helpful to teachers concerned with giving their charges a better grounding in the mathematical principles underlying textile calculations. The author, in common with other instructors, has found that the average textile student commits certain formulae and rules to memory without becoming sufficiently well grounded in the theory and science on which the formulae and rules used in spinning and weaving calculations are based and constructed. In the present treatise the author has endeavored to give a full explanation of the fundamental principles, along with an exposition of the mathematical problems peculiar to productive routine in the spinning and weaving industries. The treatise covers most of the textile field with the exception of knitting calculations. It begins with the calculations relating with the counting of single and folded yarns, "sett" systems, warp and weft calculations, etc. Then follow chapters on simple equation, indices and logarithms, and the slide rule. The mensuration of regular figures is treated exhaustively, as is also the use of square-paper graphs. Ratio and proportion, which form so large a part of textile calculations, are treated very fully, introducing proportional movements of levers, etc. Trigonometrical ratios are dealt with, this portion of the work being followed by numerous textile calculations involving percentages and proportional division, followed in turn by variation and its applications. A valuable chapter is devoted to a consideration of looms—cams and tappets. The final chapter is given over to problems concerning the construction of woven fabrics.

The whole of the work is thoroughly practical in character, and represents a considerable advance beyond anything which has hitherto been available, inasmuch as it contains sufficient of pure mathematics, combined with worked-out examples of textile calculations to give the student as much mathematical knowledge as he probably will require. An admirable feature of the work is the manner in which the examples are worked out step by step from first principles, which should enable the student to grasp clearly the basic principles enunciated and ultimately enable him to work out textile calculations without a blind dependence upon memorized formulae and rules.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 8, NO. 23
JUNE 6, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

"Wanted: A Technical Association of the American Textile Industry"—an editorial. Read it and let us know what you think of the idea.

The Application of Aniline Black to Cotton is discussed in an article prepared by the service laboratories of A. Klipstein & Co. and also in the "Inquiry Department." Various practical recipes are described in detail.

In Part V of his article on "Operations Preliminary to Dyeing Wool Fiber" Professor Olney describes processes and mechanical equipment for wool drying.

"A Time-Clock for Temperature in Dyeing," by Latimer J. Wilson, discusses the advantages to be gained by automatic time-temperature control of the dye bath.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 8, No. 23

NEW YORK, JUNE 6, 1921

Section 2

Operations Preliminary to Dyeing Wool Fiber—Part V—Wool Dyeing

An Outline of the Procedure Generally Followed, Together with Descriptions of Typical Wool-Drying Machines

By LOUIS A. OLNEY

(All rights reserved.)

THE squeeze rolls at the end of the last scouring bowl remove the excess of rinse water; but no matter how efficiently they may work considerable moisture remains, and this must be completely removed before the wool is in proper condition either to proceed with the manufacturing process or to be temporarily stored.

TABLE DRYERS

The first development toward the efficient drying

of wool was the introduction of the so-called "table dryer." This consisted of a rigidly constructed table or frame covered with a heavy wire grating or grid upon which the damp wool was spread out to a depth of from 4 to 6 inches. At one end of the table was located a compartment containing a large steam coil, also a blower which drew air in through the steam coil and blew the hot dry air into the compartment underneath the table. This compartment was so

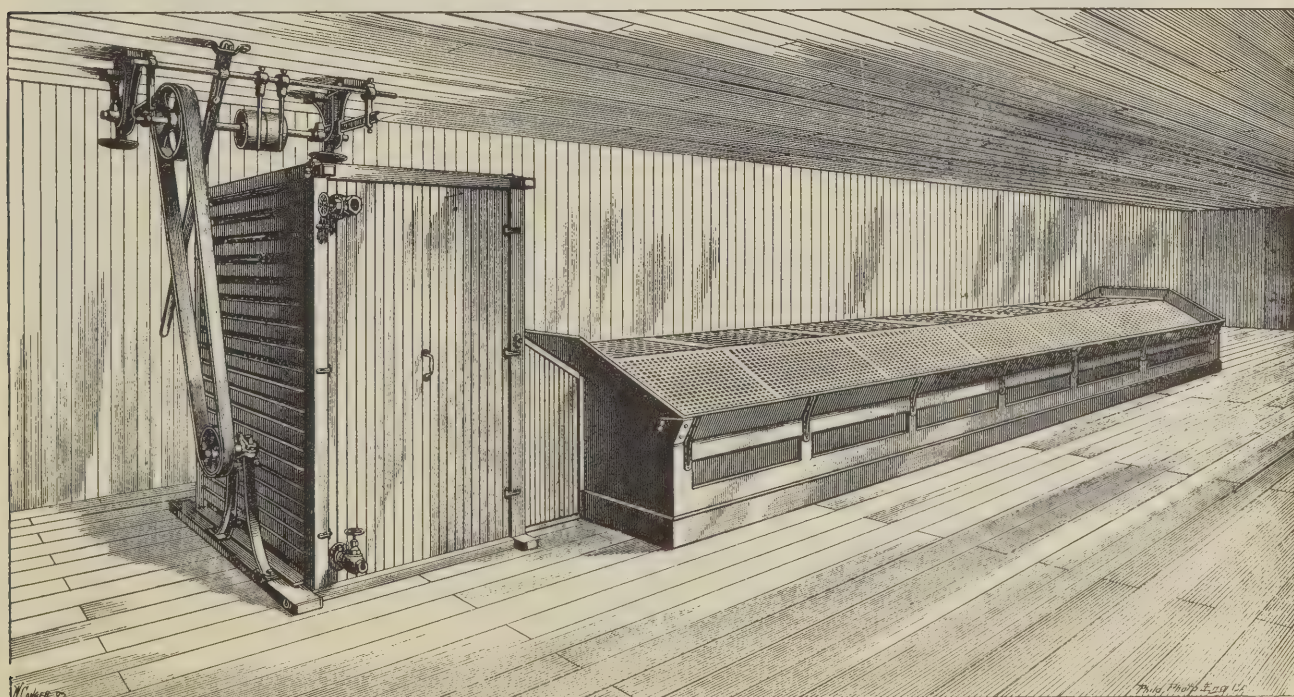


FIG. 14—Three-Section Table Dryer with Coil Box—Proctor & Schwartz

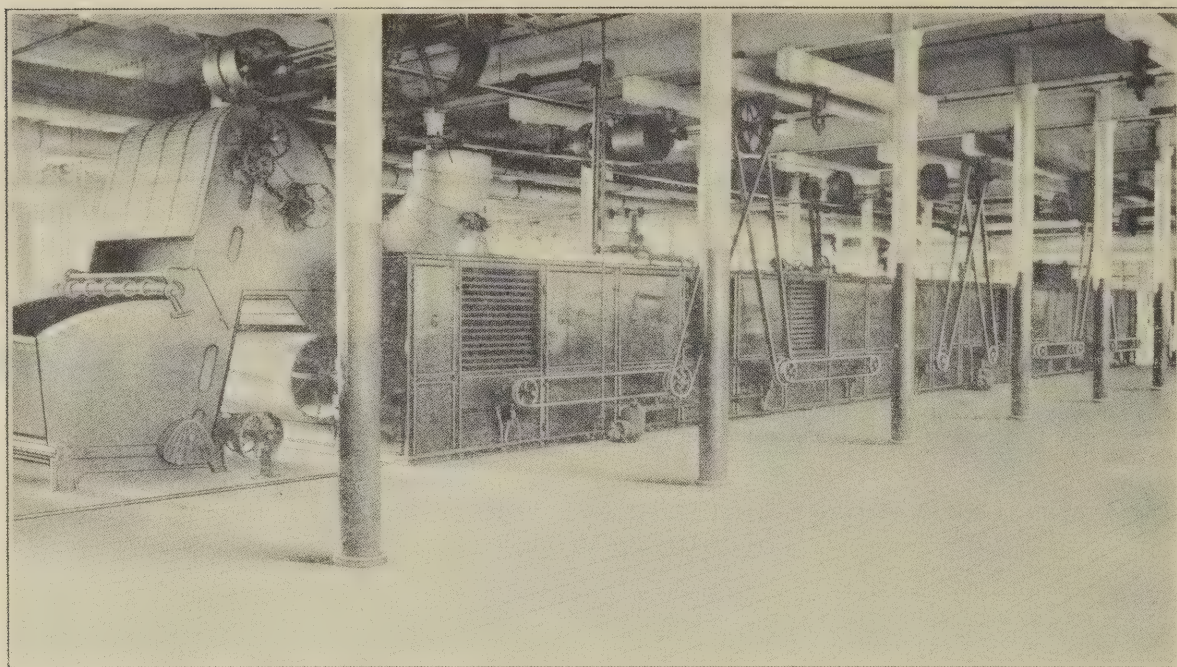


FIG. 16—*Installation of Modern Single-Apron Dryer—C. G. Sargent's Sons Corp.*

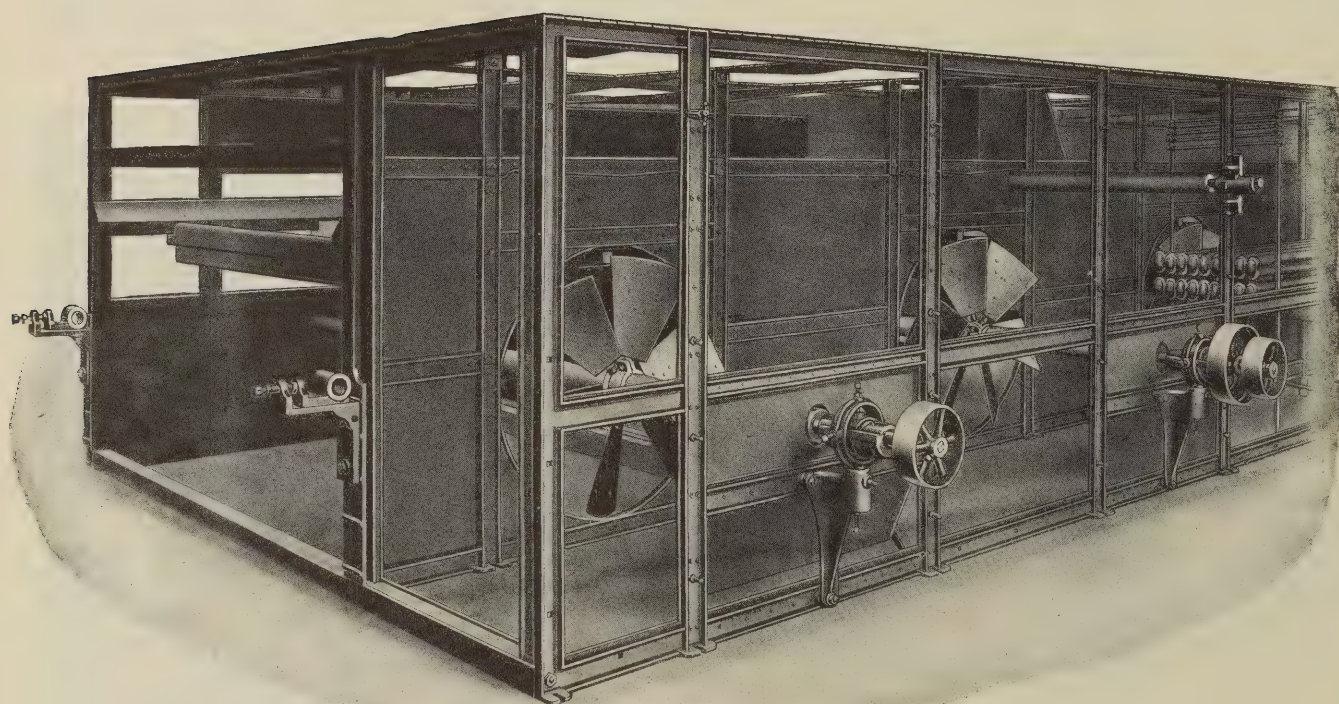


FIG. 17—*Frame Construction of a Single-Apron Dryer—C. G. Sargent's Sons Corp.*

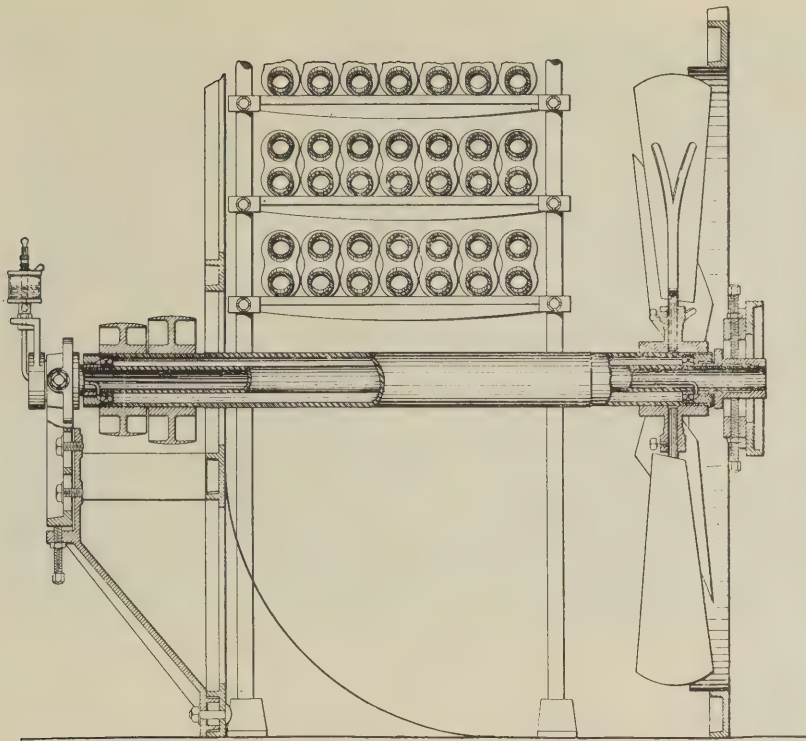


FIG. 18—Sectional View of Fan Mechanism—
C. G. Sargent's Sons Corp.

boxed in that the only possible means of escape for the hot air was up through the wool which gradually dried.

Such a table dryer is illustrated in Fig. 14 as a complete installation, while Fig. 15 gives the detailed construction of the coil and the location of the fan. In order that the floor space required for this coil chamber may be reduced to a minimum, it is built high and the quantity of air passing through is made uniform

in the removal of grit and dirt, as is so effectively done in the automatic continuous apron dryers, which for these reasons have almost entirely re-

for all parts of the coil by increasing the distance between the cross-slats as they approach the top. The three-section table illustrated is approximately 36 feet in length and has a capacity of about 1,500 pounds of wool a day. Swinging doors, controlled from the outside, are frequently provided between the sections, so that a four-section machine may also be used either as a one, two or three section dryer.

The table dryer, while valuable in the small plant for handling a limited output, is comparatively slow in operation and requires considerable labor. Furthermore, it fails entirely in opening up and mixing the stock, and assists in no way

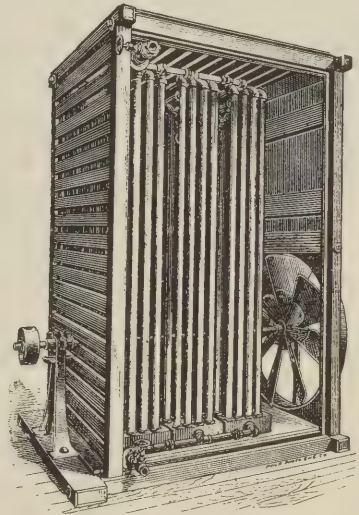


FIG. 15—Coil Box of Table Dryer--
Proctor & Schwartz

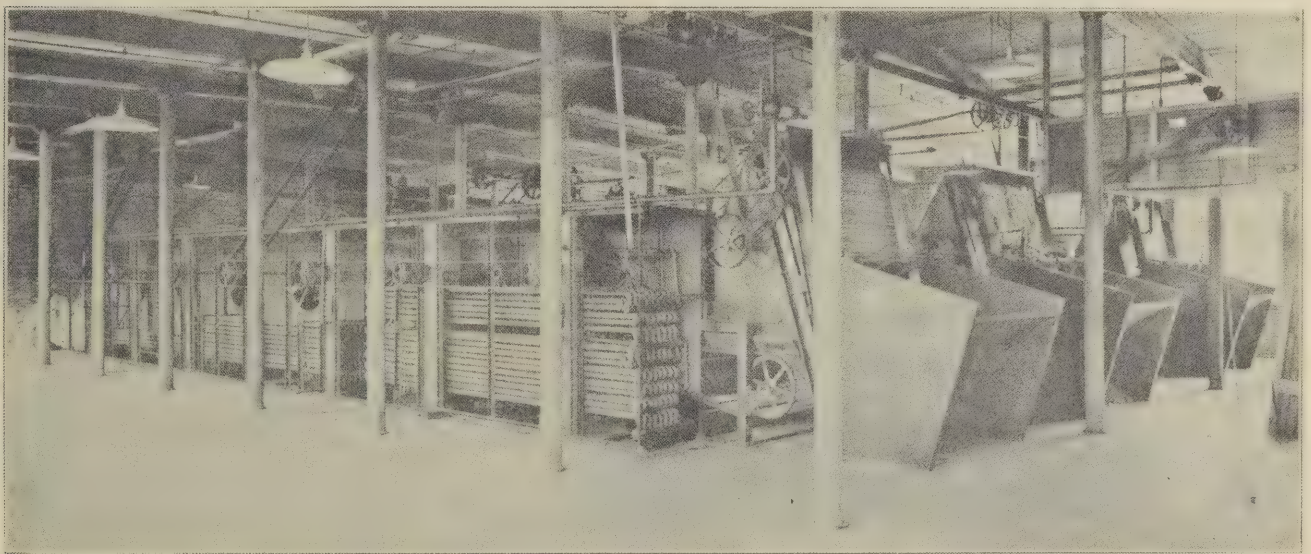


FIG. 20—Installation of Three Single-Apron "Hurricane" Automatic Stock Dryers with Automatic Feeds—Side Panels Removed, Showing Arrangement of Steam Coils—Philadelphia Drying Machinery Company

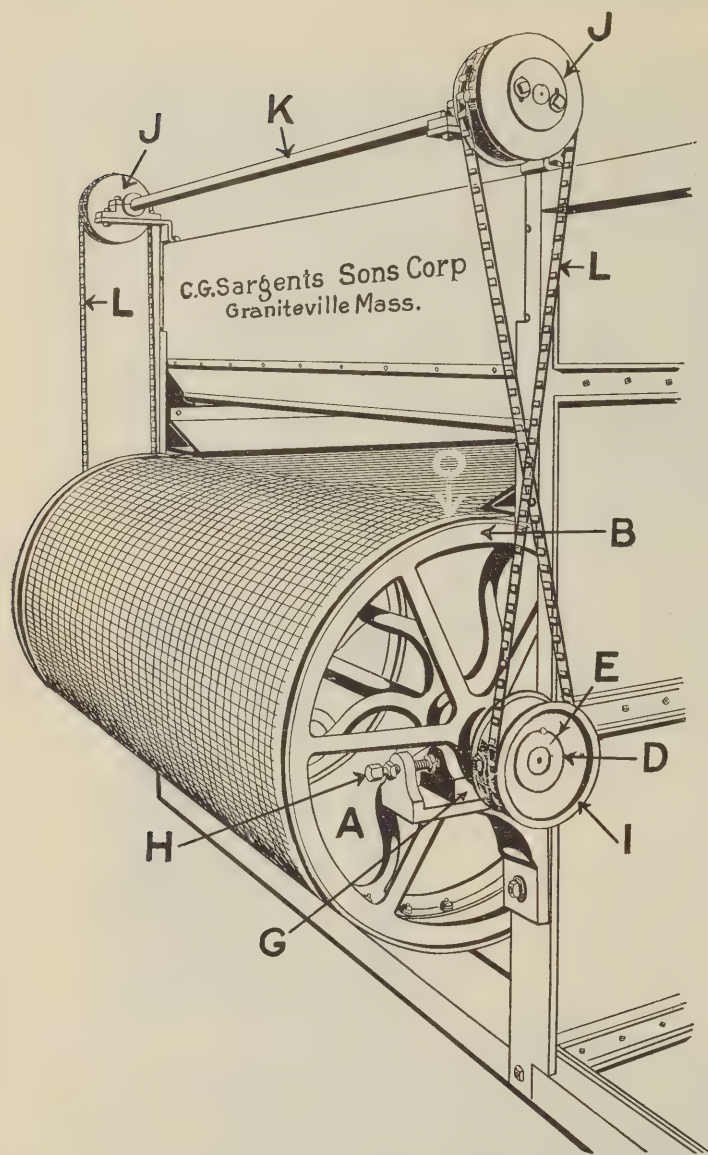


FIG. 19—Automatic Apron Controlling Device—
C. G. Sargents Sons Corp.

placed the table dryers in all modern plants of any considerable size.

AUTOMATIC CONTINUOUS DRYERS

During recent years much attention has been paid to the drying of raw stock. Study has been made both as regards economy of steam and the condition in

which the stock is left. As a result there have been developed several very efficient continuous dryers.

A typical continuous dryer consists of a long rectangular chamber through which an endless wire screen circulates. At one end there is an automatic feeder, which drops the wool regularly and equally distributed upon this traveling apron. Located upon one side of this main chamber is an auxiliary compartment containing extensive heating coils and a series of fans, which insure an abundant circulation of hot air up through the wool as it slowly passes from one end of the drying chamber to the other. The fresh air is drawn into the drying chamber near the delivery end of the dryer, coming in contact with the dryest and coolest wool, while the air which has become more or less saturated with moisture is drawn from the chamber by means of an exhaust fan located at the feed end.

In Fig. 16 there is illustrated an installation of a typical continuous wool dryer. At the extreme left hand is the automatic feed, which is in reality a complete machine in itself, and directly behind this may be seen one of the drums over which the continuous apron passes.

To insure economy and uninterrupted working, and delivery of the stock in the proper condition, a number of important considerations must not be overlooked.

ECONOMY OF HEAT COMBINED WITH FIREPROOF CONSTRUCTION

In order that heat may be economized as much as possible the walls of the dryer must involve some form of non-heat-conducting construction. In some instances the walls are built of panels made by folding together two sheets of metal which are lined with air-cell asbestos. In other cases the walls of the dryer are covered with asbestos board, or an application of asbestos and magnesia. In this way it is not only possible to construct a dryer which reduces surface radiation to a minimum and maintains the temperature within at a maximum, but one which is at the same time fireproof. The frame construction of the dryer illustrated in Fig. 16 is shown in Fig. 17. This type of construction does not expand or contract excessively, furnishes a rigid support for all moving

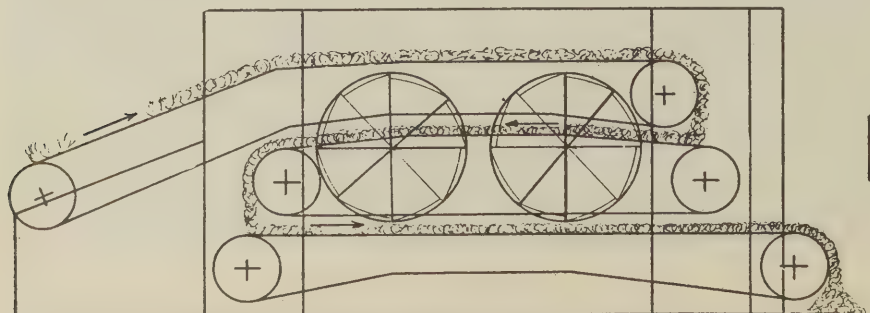
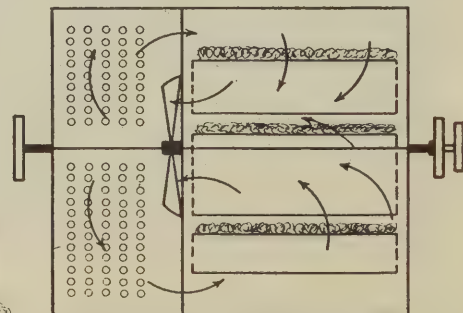


FIG. 21—Longitudinal Vertical Section of Three-Apron Dryer
Proctor & Schwartz



Cross Section of Three-Apron Dryer

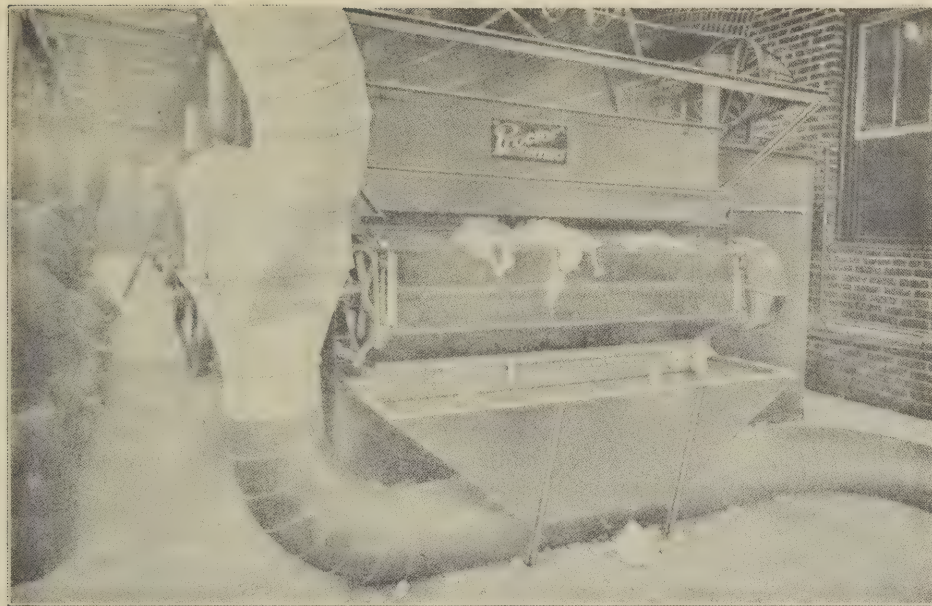


FIG. 22—Delivery End of Single-Conveyor Dryer—Procter & Schwartz

parts, and maintains perfect alignment. The detailed mechanism of the fan of this dryer is shown in Fig. 18.

UNINTERRUPTED AND REGULAR

In order that the apron may revolve evenly and without interruption, particularly upon large-size dryers, it must not be allowed to become too loose through expansion when it is heated or too tight through contraction when it becomes cold. This is very satisfactorily taken care of in the automatic apron control illustrated in Fig. 19. It is accomplished through the use of self-aligning ball bearings working in conjunction with eccentrics, thus providing the necessary sensitiveness and immediate adjustment of the drums. By this means the apron is also maintained in its normal path of travel. The letters used in Fig. 19 indicate the individual parts as follows:

A, drum; B, patent bevel adjusting pulley; D, drum shaft; E, eccentric bushing; G, drum box; H, adjusting screw for drum box; I, chain drum on eccentric "E"; J, chain drum on cross-shaft "K"; K, cross-shaft; L, chains connecting drums "I" and "J"; O, wide part of bevel on adjusting wheel.

GRADUAL COOLING OF WOOL

To insure the best results it is customary to give the cool damp wool which is just entering the dryer, and which is least likely to be injured, the greatest amount of heat. As the drying proceeds, the heat is gradually diminished by reducing the number of heating coils. This is plainly shown in Fig. 20, where the sides of the heating compartment have been removed for the entire length. In this case the heating capacity of

the first section is about double that of the second and four times that of the third. In a similar way the extreme length of the dryer shown in Fig. 16 is of special value in that it makes it possible to dry the wool at a comparatively low temperature and insures its delivery from the machine in a cool condition, with its natural softness preserved.

MULTIPLE-APRON DRYERS

While most dryers are of the single-apron type, it is desirable when floor space is limited to install a more compact machine. This is accomplished by the use of sev-

eral distinct aprons, usually three, placed one above another and so located that the wool drops from the end of one on to the beginning of the one below, as is shown in outline in Fig. 21. In general construction and appearance such three-apron dryers are similar to those carrying a single apron but are necessarily higher and require a little more driving mechanism. This type of dryer has the advantage of turning the wool over twice during its passing through the machine, permitting more uniform drying, which is often desirable with long fiber stock.

In the single-apron dryer a "revolving kicker" is frequently installed about midway of the drying chamber, which turns over and redistributes the wool. Upon leaving the delivery end of the dryer the wool goes either to the storehouse or to the picker room. In modern installations the wool is usually conveyed

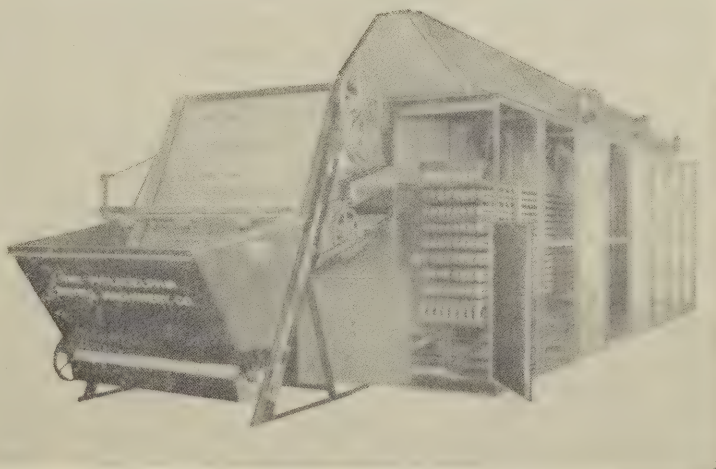


FIG. 23—"Hurricane" Single-Apron Automatic-Feed Wool Stock Dryer

by means of a large pipe and blower. The delivery end of such a dryer is shown in Fig. 22. Another type of single-apron dryer is shown in Fig. 23.

In this section only machines used for the simple drying of loose wool have been described. Slightly

different types are used for the drying and baking of wool during the carbonization process, also for the drying of yarn and cloth. These, however, will be mentioned later under the proper heading.

(*To be continued.*)

Application of Aniline Black to Cotton

Working Formulae for Various Methods Found to Yield Good Practical Results

Prepared by the Service Laboratories of A. Klipstein & Co., New York

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FOR dyeing cotton Aniline Black the most usual oxidizing agent employed is bichromate of potash or chromic acid. According to the temperature at which the dyeing is effected, two methods may be distinguished, namely, the warm method and the cold method.

WARM METHOD

For 200 pounds of cotton the dye bath contains the following ingredients: 350 gallons of water, 88 pounds of hydrochloric acid, 34 deg. Tw., 22 pounds of aniline oil, 20 to 30 pounds of bichromate of potash.

These proportions may be varied according to the particular shade of black required. A portion of the hydrochloric acid may also be replaced by an equivalent amount of sulphuric acid. Use, for example, 52 pounds of hydrochloric acid and 13 pounds of sulphuric acid, 168 deg. Tw. The intensity of the color, however, is always regulated by the amount of aniline oil employed.

The aniline and hydrochloric acid, diluted slightly with water are carefully mixed in a suitable glazed earthenware vessel, and the acid solution of aniline hydrochloride thus obtained is added to the dye bath previously filled with cold water. The bichromate of potash is dissolved separately in a little warm water and added to the bath.

The cotton is worked for one hour in the cold solution until, indeed, it has acquired a considerable intensity of color, after which the temperature is gradually raised to 120 to 140 deg. Fahr. The whole operation may last from one to three hours.

Another method is as follows: Dye the cotton in the cold for one hour with only half the quantity of the several ingredients added to the bath, then add the remainder and continue the dyeing in the cold for one hour longer; after this raise the temperature gradually to 120 to 140 deg. Fahr. and continue the dyeing for another hour.

The more concentrated the solution and the greater its acidity, the more rapidly does the dyeing take place. Excess of acid and prolonged heating tend to give bronze-colored black, and much of the coloring matter is only superficially fixed. If, however, the heating has been of short duration, the black has a bluish tone, and is liable to become green under the influence of acids.

It is essential that the temperature of the bath should be

raised very gradually, otherwise there is a great loss of coloring matter since much of it is then precipitated in the bath and not on the fiber.

After dyeing, the cotton must be well washed with water, then boiled in a solution of soap containing 77 to 150 grains per quart with or without the addition of a little carbonate of soda, and finally dried.

COLD METHOD

According to this method the dyeing operation is conducted entirely in the cold, the proportions of the ingredients and the concentration of the bath being altered to render this possible.

For 200 pounds of cotton use 35 to 44 pounds of hydrochloric acid, 44 pounds of sulphuric acid, 17 to 22 pounds of aniline oil, 30 to 44 pounds of bichromate of potash, 22 pounds of ferrous sulphate. The quantity of water should be very much smaller than in the warm method, otherwise the dyeing would either be incomplete or would take too long.

It will be noticed that the proportions of bichromate of potash and acid employed in the cold method are larger than in the warm method; this is in order to facilitate the oxidation of the aniline salt at the lower temperature. The addition of the sulphuric acid has a similar effect, but it also tends to yield ultimately a more pleasing tone of black. The use of hydrochloric acid produces blue-blacks, while sulphuric acid alone gives such as are of a reddish cast. The addition of the ferrous sulphate is for the purpose of rendering the black less liable to turn green. Of course, in the bath it is changed to ferric sulphate, and this acts as an oxidizing agent.

The method of preparing the dye bath for the cold method is similar to that already described. The aniline hydrochloride is previously made by mixing the aniline and hydrochloric acid; separate solutions of the ferrous sulphate, bichromate of potash and sulphuric acid are also kept in readiness. The cotton is first worked for about one hour with only half the full amount of the several ingredients in the bath. At the end of this time, when the cotton has already acquired quite a black color, it is lifted out, the other half of the ingredients is added;

the cotton is then re-entered, and the dyeing is continued one to one and a half hours longer.

After dyeing, the cotton is well washed and boiled with a solution of soap and carbonate of soda, as previously stated, and dried. The use of soap alone gives violet-toned blacks; the addition of carbonate of soda makes the shade bluer.

Although the black produced by either of the above methods, but especially by the cold method, is tolerably stable, it is necessary, in order to render it perfectly ungreenable, to submit the dyed cotton, after washing, to a supplementary oxidation. Several methods have been proposed for this purpose, but perhaps the following, in which ferric sulphate is the oxidizing agent, is the most serviceable: Prepare a mixture of 44 pounds of ferrous sulphate, 11 pounds of bichromate of potash, 33 to 39 pounds of sulphuric acid, 168 deg. Tw., 23 to 15 gallons of water. Add 1 pound of this mixture to 100 pounds of water, and work the cotton in the solution for three-quarters of an hour at 147 deg. Fahr.; then wash well, boil with soap and dry.

OTHER METHODS

Another method, depending for its efficacy upon the optical effect that a mixture of violet and green appears blue, is to dye the black in a weak solution of Methyl Violet. This violet is fixed, it is supposed, by reason of the cotton itself having been partially oxidized and changed into oxycellulose during the dyeing process.

Two other methods of producing Aniline Black on cotton, though not practically employed, possess sufficient interest to deserve mention. One is that borrowed from the method so successful in the printing of calico with Aniline Black. It is based upon oxidizing the aniline salt by means of potassium chlorate in the presence of vanadium. The cotton is impregnated with a somewhat

concentrated solution containing 5 to 20 per cent of aniline hydrochloride (according to the intensity and fastness of the black required), 2 to 10 per cent of potassium chlorate, and a very minute quantity of vanadium chloride (not more than one three-hundredth of the weight of aniline hydrochloride employed.) After wringing out the excess of liquid, the color is developed by hanging the cotton in an aging stove heated to 57 to 76 deg. Fahr., and in which the air is kept slightly moist by admitting a little steam. The chief defect of this process is that an uneven color is likely to be produced, since the oxidation will take place unequally if there is partial drying of the fibers, or an unequal exposure of the fibers to the air.

The other method referred to is that proposed by Gopelsroeder, in which a vat of reduced Aniline Black is made, the cotton being dyed in it just as in an indigo vat.

The Aniline Black is first prepared separately, namely, by heating a solution containing aniline hydrochloride, potassium chlorate, ammonium chloride, and copper sulphate. The black pigment thus produced is purified by boiling with water, and afterwards with alcohol. It is then heated with a solution of caustic potash, and the color base of the black thus liberated is washed, dried, and dissolved in fuming sulphuric acid. This solution is poured into cold water, and the greenish-black precipitate thus produced is dissolved in caustic alkali and reduced by heating with the addition of glucose, hydrosulphite of soda, or zinc powder. Ferrous sulphate and lime are inoperative. If cotton be steeped in the brownish-yellow solution thus obtained, and then exposed to the air, it acquires gradually a blue color. By submitting this color to a supplementary oxidation it changes to a light gray or deep black, according to the concentration of the vat. A judicious combination of the Aniline Black vat with an indigo vat may yield very fast deep blues.

A Time-Clock for Temperature

Greater Efficiency in the Dyehouse, Together with Considerable Savings in Steam and Labor, Are Obtainable by the Use of Modern Time-Temperature Control Devices

By LATIMER J. WILSON

WHAT would happen to an industry where neither the employer nor the employee kept a record of the time spent in work? "How long did you work to-day?" might inquire the foreman. The millworker would scratch the top of his head and ponder a few minutes before replying, "Oh! I guess about eight hours."

If this were the everyday procedure by which employees were paid there would be frequent disputes between the manager of an industry and his men. But such disputes cannot arise, because there is an absolute record kept of the time spent in work, and the best sort of a record is one which is automatic—the factory time-clock. It prevents the workman from being cheated by a mistake as well as it protects the employer.

To apply this to the dyeing industry one might consider "temperature" an employee. The degree of temperature and the time are vital factors in the success of the industry, yet some establishments still resort to haphazard methods of regulating time and temperature in dye baths. There is a time-clock for the employees, but there is none for the dye kettles, vats and drums. When a temperature must be slowly raised there is a wide range of variety in the progress of "how slow." If a dye bath must be increased 120 degrees in twenty minutes or in two hours, there is a marked effect in the result of some dyes. Manual efforts to adjust the temperature result at best in more or less waste of steam. Automatic, mechanical adjustment reduces the process to a scientific plan where uniform results can be expected.

There are thermometers which automatically operate a controlling valve to stop the increase of heat beyond a certain degree. For instance, in sulphur black dyeing an automatic temperature control thermometer fixed to the drum dyeing machine will maintain whatever temperature is desired. The manner of this kind of regulation is simple, and its value over the old method of merely relying upon an employee to stick a thermometer into the bath and note the degree at intervals is undoubted. Both time and fuel are saved by the use of automatic temperature controlling thermometers.

It is possible to put a "time-clock" also on the dye kettle. Instead of keeping a man busy regulating the temperature of a kettle by holding a watch in one hand, it is possible to put a self-regulating time-thermometer on the kettle. Then the whole process is under strict mechanical control. This device has, of course, to be calibrated to the requirements of whatever batch of material is to be dyed. If different conditions are introduced for one bath or another, then, of course, the instruments must be adjusted accordingly. But great saving of labor and steam results from a scientific control of the dye bath.

Any mechanism works best and lasts longest when it is run with regularity. If a man eats his meals at irregular intervals his digestive machinery is soon out of repair. There is an economic loss in the health of the individual and in the wasting of food. To attempt to regulate the steam supply for the heating apparatus of the dye bath by manual effort is like putting too much food before a man who has perhaps just had his dinner. To keep the dye bath from possibly falling below temperature an oversupply of steam is perhaps used. But when the temperature is timed by a clock which automatically controls the steam supply in connection with a recording thermometer, there is no danger of wasting steam.

It is possible to keep a thermo-time record of dye baths where compound or double duty work is imposed upon the thermometer, that is where it is necessary for the regulator to have both a temperature controlling member and a condensation discharge member. The cam of the regulator has, of course, to be calibrated for its particular system, but where only one or two temperatures are of importance it will not be necessary to do this. In one type of instrument the cam revolves by means of a clock movement permitting the air-valve block to slide up or down, thus regulating the amount of air that can get through to the diaphragm steam valve.

To adjust the thermo-time regulator is a simple matter. The clock is started by a button on the front of the clock case. The cam of the desired time interval is easily fixed by unscrewing a thumb-nut which permits one cam to be quickly removed and replaced by another of a different time interval. The initial temperature adjustment is made by turning the adjusting post underneath the cam. The air valve can be quickly and easily cleaned by merely removing the cam and unscrewing the valve cap below the pointer.

In some of the more complicated temperature requirements of a dye bath it is necessary to raise the temperature a certain number of degrees in a definite interval, at which temperature it is held for a period. Then the temperature must again be increased to a certain point and held, and possibly a third increase and stationary interval may be necessary. To rely upon human watchfulness to accomplish this result demands the most reliable labor. Even at the best there are sure to be days of irregular performance with a consequent loss of efficiency and waste of steam. Some materials depend vitally upon the precision of temperature and time, the lack of which produces spotty, streaky or imperfect colors. With an automatic temperature-time adjustment this dangerous possibility is entirely overcome.

When wool and cotton mixtures are to be dyed in the same bath the variation of temperature is all important combined with the **time factor**. For instance, in substantive dyeing it is customary to adjust the color on the two fibers purely by a change of temperature. At definite low temperatures the cotton will take up the color more strongly than the wool, while at temperatures near boiling the wool takes up the color more strongly than the cotton. Thus the wool is dyed almost to the required depth at the proper temperature and then the bath is allowed to cool off until the cotton is dyed. But the rate of cooling as well as the degree can be mechanically controlled to such an extent that very uniform effects can be produced. In wool, cotton and silk mixtures where direct colors are dyed in a salt bath uniform shades are obtained easily by a careful adjustment of temperatures, the cotton and silk generally being dyed at about 160 deg. Fahr., while the wool is dyed at a point near boiling. There are numbers of processes in which the uniformity as well as the quality of the color depends upon the thermo-time factors.

It is a simple matter to put a "time-clock thermometer" on the dye kettle, drum or vat. It is an easy matter to set it for the desired temperature increase. The clock movement revolves a cam which manipulates an air-valve block, permitting the air flow to operate the diaphragm of the steam valve. When the desired degree has been reached the regulating thermometer halts the increase and the dye bath is held at a definite temperature for a definite period. From the recording chart of the thermo-time regulator one can see exactly what temperature at any given time the dyeing bath reached. Such instruments are invaluable to the industry in experiments with new methods and new colors.

EGYPTIAN IMPORTATION OF DYES

The amounts and values of dyestuffs (exclusive of natural and synthetic indigo) imported into Egypt for the first eight months of 1919 and 1920, respectively, were 104,700 and 189,400 pounds, valued at \$98,000 and \$146,000. Values are converted into dollars at the normal rate of exchange (20.23 piastres to the dollar). Dyestuffs are usually imported into Egypt by resident commission merchants.

Papers Read Before Dye Section of A. C. S.

Abstracts of Technical Papers Presented at the Rochester Meeting of the American Chemical Society

THE meeting of the American Chemical Society at Rochester, N. Y., the last week in April was the occasion for the presentation of several papers on technical subjects before the Dye Section of that Society. Considerable discussion relative to the importance of the dyestuff manufacturing industry to America and the necessity for protective legislation also took place, but this matter has already been covered in the regular weekly issues of *The Reporter*.

Abstracts of the principal technical papers follow:

Contribution to the Estimation of H Acid

By H. R. LEE

The stability of diazo-benzene and p-diazo-toluene is taken up from the standpoint of their use as standard volumetric solutions. Data showing the relative stability of these diazo salts, both in acid and alkaline solution, are presented. Tables showing comparative analyses of a large number of samples of commercial and pure H Acids are given. The method used by the Newport Company for the analysis of H Acid is outlined. The use of p-diazo-toluene for the analysis of a number of amino-naphthol-sulfonic acids other than H Acid is suggested.

A New Alizarin Process

By CHAS. W. SCHAEFFER

This process depends on a cheap process for manufacture of pyrocatechol and then the synthesis of Alizarin according to Baeyer and Caro from pyrocatechol and phthalic anhydride.

In this process Phenol is nitrated and reduced with Zinc, giving Ortho and Para Amino-phenol. This is diazotized, not filtered, and the diazo solution run directly into the still. In the distillation the diazonium chloride, being unstable, is decomposed—water and acid first coming off—and at 243-245 deg. Cent. the pure pyrocatechol comes over. The p-Amino-phenol may also be diazotized and sublimed, giving Hydroquinone.

Contribution to the Chemistry of Malachite Green

By JOSEPH H. MINEVITCH

Tetramethyldiamidotriphenyl Methane, which is prepared by the condensation of dimethylaniline and benzaldehyde in the presence of hydrochloric acid, when oxidized with lead peroxide as a solution of the dihydrochloride either with or without sufficient acetic acid does not give exclusively the Tetramethyldiamidotriphenyl carbinol. The influence of the acetic acid is a very interesting phenomenon of the chemistry of this oxidation reaction. The tetracarbinol possesses crystalline properties and forms Malachite Green crystals either as the oxalate or the zinc double chloride salt.

What actually does form in this reaction is a mixture

of carbinols, one of which—probably a triphenyl derivative—possesses little or no crystalline properties and forms amorphous salts with oxalic acid or zinc chloride.

Varying the amounts of hydrochloric and acetic acids produces a carbinol with varying crystalline properties. Hydrochloric acid corresponding to the methane dihydrochloride and in the presence of at least 2.25 molecules of acetic acid gives the maximum of the tetramethyl derivative. Oxidation without acetic acid produces a carbinol or a mixture of carbinols which is so weak in crystalline properties as to form little or none of the crystalline Malachite Green salts.

Dyes Derived from Beta-oxynaphthoic and J- Acids

By A. WILLIARD JOYCE

The dyes derived from Beta-oxynaphthoic acid and its arylamides form a valuable class of colors which have received little attention by manufacturers of dyes in this country. The colors made from Beta-oxynaphthoic acid are mostly insoluble in water and oil, and are of special interest to the makers of lake pigments. Those derived from the arylamides of Beta-oxynaphthoic Acid are of value as pigments and also as colors developed directly on cotton, when used in combination with a diazotized arylamine. This class of colors has been developed chiefly by the German firms of Meister Lucius & Bruning and Griesheim-Elektron.

The dyes derived from J- Acid have likewise received little or no attention by manufacturers in this country. This class of colors are valuable direct cotton colors of good fastness, especially to acids and of great clearness and brilliancy of shade. These colors from J- Acid and J- Acid derivatives have been greatly developed by the leading German dye manufacturers. The Bayer Company has been foremost in this development, but it has been closely followed by the firms of Cassella & Co., Meister, Lucius & Bruning, and Kalle & Co.

The Chemical Foundation, Inc., owns patents which cover dyes made from the above intermediates.

The Quantitative Determination of Phenanthrene

By ARTHUR G. WILLIAMS

Phenanthrene in crude phenanthrenes may be quantitatively determined by oxidation in glacial acetic acid solution by iodic acid to phenanthraquinone followed by precipitation of the quinone, also in glacial acetic acid solution, as toluphenanthrazine by 3, 4-tolylene diamine. The hydrocarbon may be conveniently detected qualitatively by oxidation in glacial acetic acid solution by means of KBrO_3 or HIO_3 followed by precipitation by water, filtration, extraction of the residue by NaHSO_3 liberation of the quinone by means of HCl and FeCl_3 extraction with CCl_4 , and final detection of phenanthraquinone by means of the Hilnert and Wolf test with SbCl_5 in CCl_4 .

Bleaching, Dyeing, Printing, and Finishing

By BENJAMIN LEECH
Consulting Chemist, Macclesfield

Editor's Note.—The following resume of recent scientific articles and developments pertaining to the subjects covered by the above title comprises a chapter in the Annual Report for 1920 of the Society of Chemical Industry on Applied Chemistry—the first copies of which have just reached this country. Inasmuch as this volume does not enjoy wide circulation in America we felt that our readers might be interested in this record which the Society has caused to be prepared. If complete copies of any of the articles mentioned are desired, we shall be glad to refer inquirers to the original sources.

PROGRESS during the year 1920 in the bleaching, dyeing and printing industries has been rather in the direction of a better understanding of the nature of processes already existing than in the invention of processes of striking originality. The work of the research committees in the various branches of these industries has not yet produced any results which may be acclaimed as of outstanding merit or utility. It is no doubt too early to expect such results, and it is possible that much that has been done has been communicated privately to the subscribing firms. Still, we are tempted to question whether the association between the research laboratories and the works is sufficiently intimate. No doubt this intimacy is one which can only be of gradual growth, but there is at present a lack of obvious co-ordination which might be established to foster that growth. For example, the investigator engaged in any piece of research should be given an opportunity of observing, on the spot, existing works' practice in connection with the subject of research before the scope and nature of that research is defined. The form of statement of the technical problem requiring solution is frequently such as to mislead the investigator at the outset, and there is a wealth of accumulated experience and observation behind works practice of which he may remain ignorant, because it is rarely realized vividly in the minds of works' managers, much less put into the form of accurate and comprehensive statement. The task of reviewing the patent literature of the year suggests that the research associations might very well undertake trials of the processes described in new patents and issue reports on these, on the lines of the reports issued by the Societe Industrielle de Mulhouse. Such impartial reports would be valuable both to the patentees and to those engaged in the industry. The results which the research associations have published during the year are not assembled together in the present review, but are quoted incidentally with other published matter on the same subjects.

The elaborate pattern cards and directions for carrying out special processes which were issued by the German dye makers in such profusion in pre-war days are conspicuously absent in 1920. The corresponding literature at present issued by English firms is notably meager. The activities in the color industry have not yet borne fruit of this description. On the other hand, there are many indications that the chemical privations of the war have had a stimulating effect on dyers, and long-established processes have undergone a critical examination which has been highly beneficial.

Information which was of necessity withheld during the war is being gradually disclosed, but the bulk of it is rather of historical interest than of outstanding technical utility.

GENERAL

A paper by W. H. Nuttall on "Wetting Power and Its Relation to Industry" is of special interest to dyers. The author deals very fully with the physical laws which govern the phenomenon of wetting; and although he draws his industrial examples from other industries, the application of his paper to the practice of scouring, the degumming of silk by the froth process, froth dyeing and numerous other processes will be apparent to every dyer. The paper does not lend itself to such short abstraction as could be given here, but it is full of suggestive material.

Considerable attention has been directed during the last twelve months to the use of cellulose acetate produced by the British Cellulose Company by the Dreyfus process. This product was used during the war as a dope for aeroplanes, and an outlet has been sought in the production of artificial silk. One of the main difficulties in the way of its successful employment in this way has been the problem of dyeing it satisfactorily. Reference to this point was made in an article by L. P. Wilson, to which J. F. Briggs replied, without disclosing the means by which the dyeing of the

fiber had been satisfactorily carried out. Cellulose acetate silk cannot be dyed by direct cotton colors without preliminary treatment. Its lack of affinity for coloring matter seems to be associated with the replacement of the hydroxyl groups of the cellulose by acetyl groups. The presence of hydroxyl in many cases determines the affinity of a material for dyestuffs. For example, if cotton goods are mordanted with silicic acid preparatory to dyeing with basic colors, it is found that the affinity for dyestuffs is much diminished if the goods are thoroughly dried before dyeing. Many of the known methods of treating cellulose acetate silk preparatory to dyeing appear to involve a kind of hydrolysis which may be complete for a portion of the fiber or partial throughout the fiber. According to a process of Knoll & Co. Company, however, in which the silk is caused to swell by treatment with dilute inorganic acids, the inventors claim that there is no actual hydrolysis of the silk substance. Other materials which have been suggested for preparing the silk for dyeing are a mixture 50 per cent alcohol and 50 per cent acetic acid, followed by dyeing with basic dyes and 1 per cent of sodium phosphate; or a mixture of alcohol, acetic acid and acetone may be used. Basic dyes in alcohol only or in water only do not dye the fiber, but in a mixture of alcohol and water dyeing occurs. Various substances which may subsequently be developed into dyes are absorbed by a fiber directly from aqueous solution. All these processes involve considerable complexity of treatment as compared with that necessary for the dyeing of viscose. Nevertheless, the British Cellulose product possesses certain properties which distinguish it for technical use from viscose. The fact that it does not dye, that it will withstand short treatment in a mercerizing solution, and other special features make it seem probable that when the acetate silk has received further technical attention it may find an extensive use in ways in which it does not come into direct competition with viscose. Such use can only be devised by the joint efforts of dyers and designers of fabrics who work in collaboration.

C. G. Schwalbe, in an investigation of hydro and oxy celluloses, found that these substances are converted into a mucilage by mechanical means, more particularly by pressure. The mucilage is converted into irreversible colloid on drying and loses the property of swelling in an atmosphere saturated with water vapor. The mucilage is characterized by very high affinity for mordant bases. In a solution of aluminum sulphate, for example, the base is entirely removed by the mucilage, leaving free acid in the liquor. Neutral salts such as magnesium chloride are similarly affected. The formation of small amounts of such mucilage

in mechanical processes during dyeing and printing is possible, and the author suggests that the favorable results obtained in dyeing on the jigger or padding machine are to be attributed to small quantities of oxy-cellulose which are converted into mucilage by the pressure between the rollers. Other instances frequently occur in dyehouse practice in which some of the results described by the author may be accidentally produced.

SPECIAL TREATMENT OF TEXTILE MATERIALS

Messrs. Gillet et fils have taken out a number of patents in connection with the treatment of vegetable fibers by nitric acid. According to one process, raw, bleached or mercerized vegetable fibers are treated with solutions of cellulose in nitric acid for not less than half an hour without tension and then washed; according to a second process, a solution of starch in 65 per cent nitric acid is employed for the treatment of fabrics, followed by treatment with a solution of any suitable salt to aid the precipitation of the nitrated product; and according to a third patent, vegetable fibers themselves are immersed in nitric acid (65 to 70 per cent) and then washed with water. It is claimed that by these means wool-like properties are conferred on the vegetable material. Printing effects can be obtained by local application of the same processes. An elaborate process for obtaining luster on cotton yarn or cloth is described in a patent of S. Kashitani; the material is treated in sulphuric acid (sp. gr. 1.56—.71), washed in water under vibration to remove loose fibers, immersed in a solution of caustic soda, and then treated with a 3 per cent solution of borax. Other new processes for treating yarns or fabrics will be found in the section on "Finishing."

P. Kraus publishes further accounts of his researches on the bicarbonate process of retting. He finds that this process enables considerable time to be saved in retting either of nettles or flax as compared with the usual warm-water retting. Treatment with chloroform sterilizes the nettles so that retting does not subsequently occur unless the mass is inoculated with a stem of unsterilized nettle or with a culture of bacteria prepared from a retting liquor.

The use of chalk alone produces no acceleration in retting. The addition of sodium sulphite produces a much lighter, almost white flax, but the liquors acquire a very disagreeable odor. The odor is considerably improved by the addition of dextrose to the bicarbonate retting liquor. A large-scale trial using 1,000 kg. of raw flax proved the process to be very satisfactory on the big scale. Retting was complete in forty-two hours, the liquors were free from offensive smell, and the product was superior to the warm-water-retted material obtained in the same works.

(To be concluded.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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WANTED: A TECHNICAL ASSOCIATION OF THE AMERICAN TEXTILE INDUSTRY

“HE travels fastest who travels alone” is not an adage enjoying good standing among those responsible for our modern industrial development. To-day it has become the merest truism to say that in organization there is strength, efficiency, economy, and increased production. Industrial co-operation is no longer merely an advantage; economic conditions have made it an actual necessity.

This need is one which has not been escaped by the textile industry of this country, and a survey of its various parts makes it fairly plain that the particular department through which such co-operation could enter and find application to the best advantage is by way of its technologists. Time was when empirical skill alone constituted the basis of achievement in the industry; now it has come about that mill owners the country over recognize the value of a technical textile education. The trained mill man is increasing in numbers and importance, and his work is so far becoming the moving force of the industry that the textile technologists of to-day are the executives of to-morrow. But the full possibilities of their usefulness have not yet been generally realized, in part, at least, because they have lacked an organization of their own which would enable them to co-operate in a really effective manner.

The benefits to be derived from a technical association of the textile industry are obvious. It would make possible the freer interchange of ideas and could provide for the dissemination of knowledge useful to all. It might reasonably be expected to develop better acquaintanceship and morale among technical men, to stimulate the spirit of research, and to emphasize right educational methods in the industry—all of which are results worth going after. By degrees it could accumulate and pre-

serve, in the form of a library, a great mass of information much needed by textile men, and it could even assist in the preparation of a series of text-books of great worth. Very important, likewise, it could greatly facilitate the establishment of standards, particularly standard methods of dye testing. The need for the latter has been repeatedly emphasized by The REPORTER and our remarks on this subject have received endorsement from many leaders in dyestuff and textile circles. It is a need universally recognized throughout the industry, and the sole reason why it remains unfilled to-day is because of the lack of machinery for concerted action. Standard methods for textile testing and analysis should also be legitimate fields of endeavor for such an organization.

As to details, the suggestion is offered—and it is a suggestion only—that membership might well consist of active members, junior members and corporate members. The age requirement for active members might be placed at twenty-eight years or over. They should possess a technical education or its equivalent and should have been actively engaged in the manufacture of textiles or in industries or institutions related thereto for at least five years, and in responsible positions for at least three years. Fulfillment of the duties of a professor of applied science to the textile industry who is in charge of a department in a college or school of accepted standing, might be taken as the equivalent of an equal number of years of active practice. Junior members might be admitted at the age of twenty-one years or over, and should have had such training as would enable them to fill subordinate positions in the industry; or they should be graduates of technical schools of recognized standing.

Corporate members might consist of individuals, firms or corporations actively engaged in the manufacture of textiles, or in the manufacture or sale of chemicals or other materials used in the textile industry. Such a class of members would be desirable by reason of the fact that the nominal dues paid by active and junior members would scarcely avail to defray the cost of such research work as it would be to the best interests of all to have the association undertake. It has been demonstrated in other industries that the cost of research work of a really serious and ambitious character is surprisingly low to such corporate members. Each corporate member, of course, should name an individual to vote for it at meetings.

Meetings might be held two or three times a year, and during these meetings technical and engineering problems could be discussed. The organization could also accomplish much through the appointment of standing committees delegated to take specific problems under consideration.

For a concrete example of the efficacy of such an industrial body, one has only to turn to the Technical Association of the Pulp and Paper Industry, which is organized along lines very similar to those outlined above and which is unquestionably accomplishing a most important work in getting its members ready to become leaders in the paper industry of the future.

The REPORTER believes that the time is ripe for the organization of a technical association of the textile industry, and that the industry would gain immeasurably by the presence of such a body within its ranks. We shall be glad to learn the views of readers on this important subject, to give publicity to any suggestions which would be of interest along this line, and shall account it an honor if we can be of any service in aiding those desirous of bringing about the creation of such a body.

SOME OPPOSERS OF DYE PROTECTION WILL TRY TO FORGET THIS

"A BABY, a tree and a civilization must grow. You can feed and educate, prune and fertilize—but the growth is from within. You can't invent short cuts to maturity," remarks Arthur Brisbane apropos of Mr. Lenine's little Russian experiment. And so it is with an industry, particularly such an intricate and highly organized affair as a fully matured coal-tar chemical industry. Hothouse "forcing" methods will produce mere bulk in advance of the natural season, but not quality. Artificially raised fruits can be made to attain remarkable size and a strikingly beautiful appearance, but they are held by many to be deficient in flavor—which is, after all, the final objective and the reason for their cultivation. Hothouse flowers are notoriously unable to withstand the rigors of existence when transplanted to localities wherein their hardier prototypes flourish, and in precisely the same way an "incubator" industry does not possess the inherent ruggedness to exist for long when thrust with great suddenness into the field occupied by competitors which have grown in the natural way.

That is what many who alternately denounce the "forced" American dye industry because it is too big and find fault with it because it is too inadequate for American needs, overlook in their obviously hasty conclusions. Minds clogged with worn-out tradition and decayed precedents are unable to get at the new truths which are to-day presenting themselves for the earnest consideration of all peoples desiring to continue their national existence and progress, and one of the truths which most persistently eludes them is the fact that the dye industry, in this or any other country, now plays a wholly different and amazingly more vital role than the flower industry, the peanut industry, the olive oil industry or whatnot. This knowledge is common property in Germany and is fairly well distributed in the United States, but there remain many legislators in the latter country who demonstrate their lack of it by repeatedly arguing from the floor of Congress that other industries must take their chances of existence with whatever protection such and such a tariff law gives them, and that therefore the dye industry should not be favored more than others or regarded as in any way apart.

It is not a question of favoring the dye industry, which will promptly be attended to by the Sherman law the moment it shows definite signs of becoming the ruthless

monopoly which some of our legislative masters of fiction profess to see, but of favoring the United States. Not measures for its preservation, but failure to preserve it, would be "un-American." Flowers are raised for their appearance, for their decorative value; and it was this, some thousands of years ago, which called the natural dye industry into existence, to be followed within our own time by the artificial dye industry. To-day the latter has acquired a significance which most certainly did not enter the head of Sir Henry Perkin when he produced his mauve. Neither has it entered the heads of those who advocate turning it out into the international pasture to live or perish at this time. All circumstances considered, it would be unfair to any industry to do this in so abrupt a manner as that contemplated by opposers of Mr. Longworth's measure, but in the case of the dye industry it would be unfair to the country as well.

If the plea for protection rested upon the decorative and æsthetic qualities of the dye industry, it would be ridiculous. But the dye industry is a necessity. We must have it, and even ten years from to-day this nation will be in a sorry plight if it does not possess one. The "forcing" of the industry in the United States was begun because that truth was recognized five or six years ago, yet at no time has the industry been able to feel that the panes of its legal hothouse were reasonably safe for a stated period from Senatorial or other brickbats. This has been the most conspicuous reason—to those who have been associated with it—why it is not still further along the road to maturity, and one of the aspects of the situation most consistently ignored by some would-be statesmen. Excellent as its progress has been, the very uncertainty of its future has militated seriously against the application of the 100 per cent effort which would have been made by those with the capital to do so. Such an effort ought to have been applied more than two years ago, when the question first came before Congress, and its cumulative effects would have carried the industry well past the not wholly unpraiseworthy production mark which it has already achieved. Being "fostered" by a protection which may be taken away to-day or next week is not at all the same thing as having protection fixed by law to last for a given time. Had the industry even known in May, 1919, that the license system was going to continue two more years, the end of further necessity for artificial protection would be much nearer than it is. We might almost have been in a position to dispense with it altogether in another two years, although a dye manufacturer, be he German or American, never knows just how many months it is going to take him to get results when he essays the production of a new color. But at all events, what is needed now is a law like the Longworth selective embargo, eliminating the uncertainty for at least five or six years—England makes it ten!—if we would see the dye industry have a *really* equal start with other industries.

The dye industry is not asking for "favors" nor are those who espouse its cause seeking to have it pampered. The hothouse treatment was begun because it was a ne-

cessity and because that happened to be the only way in which it could be secured. If it was a necessity then it is still a necessity, and to throw it away by removing its protection before it is fully matured would be to waste the efforts of several years and leave the country in an embarrassing position as well—a species of folly hardly to be expected in this enlightened age. The industry now has quantity of production but not variety of production; it has size, yet anything but maturity. There is no short cut to that maturity and it is no more than logical, having once decided that the industry is a national necessity, to continue with the protection until its maturity is attained. There can be no dispute about its present degree of development nor can there be in future, for once it is really able to “carry on” for itself the fact will be impossible of concealment and can at once be demonstrated by some Ways and Means Committee of the future.

AN EXCELLENT SUGGESTION

THIS journal desires to place itself on record as being in hearty accord with the plan put forward by our neighbor, the *Color Trade Journal*, in its May issue under the heading: “A Suggestion for License Control for Dye Importations.” The idea appears to us to be meritorious in every way and, as the writer declares, it effectively meets every objection made against the system and would operate in fairness to all interests.

This editorial points out, truly enough, that there can be no basic objection to the license system—call it by any other name you like—for the reason that by its procedure consumers can obtain any dyestuff they need; for, if any such dye is not made in the United States they are free to import it. This has caused some of those who are wilfully opposing the passage of licensing legislation for reasons of their own to fall back upon the argument that the system is all right but that the necessary “red tape” inseparable from its administration, coupled with the possibility of valuable knowledge falling into competitors’ hands, would make it undesirable.

To meet this the *Color Trade Journal* proposes a Licensing Board consisting of an impartial business man, a lawyer and a technically trained man familiar with chemicals and dyestuffs. They should, it declares, be above suspicion of personal or business interests, and should meet once a week, preferably in New York City, to consider applications for licenses. The publishing of a weekly bulletin listing the foreign dyes applied for, without disclosing the identity of the applicants, would permit any interested persons to go before the board and oppose an application if desired, the board to render a decision in about two weeks’ time after the application is received. After licenses are granted, it is further suggested, the consignments should be made not to individual consumers or importers, but to a body, such as the Textile Alliance, acting for the board.

These are but the main points in the suggestion; full details can be found in the issue in question. The editorial records the result sending out advance copies to

the trade, which elicited replies the chief tenor of which was favorable. Some proposed that instead of having the board include a lawyer it would be better to have two technical men instead, engaging outside legal talent when necessary. This would seem to The REPORTER to be the better plan since, as correspondents of our neighbor pointed out, the lone technical member would be saddled with too great a responsibility.

If the dye consumer owes the industry a chance for existence, the industry in turn owes it to the consumer to eliminate every last possible obstacle to the latter’s complete freedom to secure whatever colors he needs, either from domestic or foreign sources. Further, once convince consumers that the dye industry means to play the game strictly on the level with them, and there will be no difficulty whatever about obtaining first-class protective legislation.

Recent Patents

Process of Washing or Scouring Wool

(1,377,790; May 10, 1921)

ROBERT MURTON POOLE and HENRY FREEMANTLE DAVIS

The process of scouring wool which consists in subjecting the wool to the action of a solution containing potassium carbonate, sodium sulphate and sodium chloride.

Textile Finishing Drum

(1,377,900; May 10, 1921)

JOSEPH LUNEPP

In a textile finishing drum, a shaft, a pair of aligned annular supports, arms securing said supports to a shaft and spacing them therefrom, a plurality of radially disposed parallel slats connecting the supports, said slats having cutaway portions at each and forming projections on the slats located against the periphery of the annular supports, and said cutaway portions forming shoulders on the slats located against the inner faces of the supports, and all of said slats including tapering portions adjacent their outer edges.

Stocking-Knitting Machine

(1,377,459; May 10, 1921)

GEORGE P. BOSWORTH (assignor, by mesne assignments, to Hemphill Co., Central Falls, R. I.)

In a combination in a stocking-knitting machine, needles, a main and supplemental feed, a main stitch cam and a supplemental stitch cam for the said feeds respectively, a cam for retiring the needles at the supplemental feed, selectors for advancing certain of the needles after being retired by said cam, and a cam for operating upon the selectors for advancing them, with

means for automatically adjusting this selector operating cam to operative or inoperative position.

Belt-Drive for Textile-Winders

(1,376,465; May 3, 1921)

EUGENE P. SEARING

In a textile-winding machine a cone-shaped pulley having a curved surface on a center of curvature about a central point outside the cone, a belt or band running from said central point around said cone-shaped pulley retaining its uniform friction on the pulley, a stand carrying rolls constituting the above-mentioned central point and said rolls forming belt-shifting means for the purpose of producing a variable speed, in connection with a groove at one end of the pulley for stopping purposes.

Two-Tone Double-Piece Dye Goods

(1,376,569; May 3, 1921)

HENRY NOLL (assignor to himself and James W. Streeton, New York, N. Y.)

The process described of producing two-tone double-dye satin piece goods, which consists in first dyeing a part of the raw silk with a fast color-resisting dye, weaving the thus dyed silk with raw undyed silk so that the colored silk will appear on one surface of the goods and the raw silk on the opposite surface, and then dyeing the uncolored surface.

Process for Waterproofing Threads and Fabrics

(1,377,110; May 3, 1910)

LOUIS GABRIEL RAYMOND AUZENAT (assignor to La Loire Artificielle de la Voulte, Paris, France)

A process of waterproofing and strengthening threads and fabrics, the tensile strength of which decreases in the moistened state, consisting in subjecting the threads or fabrics to the action of at least two substances in a gaseous state, said substances reacting upon each other while in such state to synthetically form compounds impenetrable to water.

Combination Filter-Press and Dryer

(1,377,022; May 3, 1921)

JOHN JAY NAUGLE

In a filter-press, a casing presenting a stationary wall section and a movable section complementing the wall section to form the housing, means for locking the two sections together, a shoulder on the wall section, filter-plates within the housing extending from the wall section and supported by the shoulder, means forming joints between said plates and wall sections through which communication may be established with the plates through the wall section, and means locking the plates to the wall section, and adapted to maintain tight joints between the plates and the wall section.

Method of Coloring and Finishing the Surface of Grain-Leather

(1,376,931; May 3, 1921)

WYMAN H. MEADE and SVEN H. FRIESTEDT

As a new article of manufacture, leather having a surface coated by metal precipitated from a soluble compound.

NEW USE FOR COCOONS

A rather novel use for spent cocoons is proposed by Mons. R. Delubache in B. P. 147,568, namely as a fabric substitute. The cocoons are used entire, the skins being withdrawn by means of a hook. They are next moistened and, if necessary, flattened by a press or mallet. If desired they may be felted. Next, the cocoons are arranged horizontally, one next the other in piles so that their edges overlap similar to fish scales or roof tiles. Afterwards they are joined together by glue, rivet, or by sewing. The advantages of a fabric substitute of this character are that it is warm, light and strong.

Uneven Piece Dyeing of Woolens and Worsteds—Part II

By R. R. SLEEPER

TOO RAPID INCREASE OF THE TEMPERATURE DURING THE DYEING OPERATION

ABSORPTION of the dyestuffs by wool increases as the temperature of the dye liquor rises. It is therefore advisable to start the dyeing operation at a comparatively low temperature. If this procedure is not followed, unsatisfactory results, due to rapid absorption will very likely be obtained.

INSUFFICIENT BOILING DURING DYING

An active boiling should take place when medium or heavy weight fabrics are being dyed with acid or chrome colors.

Active boiling assists in penetration and evenness is due to the fact that the pieces are kept constantly in motion and a more even distribution of heat results.

Special precaution should be taken when handling very light weight or loosely woven fabrics as such materials

will not stand the harsh treatments to which some classes of fabrics are subjected.

OIL IN THE DYE LIQUOR

The presence of oil in the dye liquor will sooner or later cause trouble, and especially so if light fancy shades are being produced. Its introduction is very often due to the careless oiling of bearings or drippings from the same. At times it is introduced with the steam used for heating the liquor if an open coil heating arrangement is in use. Its presence in the steam is very often due to new pipe installation or to the fact that oil has been introduced into the boiler for the purpose of keeping boiler scale in a finely divided condition.

SOAP OR GREASE IN THE CLOTH

For the obtainance of satisfactory shades, the pieces should be absolutely free from foreign matter and more especially so that of a soapy or greasy nature.

Heavy weight goods when delivered to the dyeing department from the finishing department are very apt to contain a small amount of soap. Its presence is due to incomplete removal in the finishing department and if the dyer is not positive that the pieces are free from soap, it is advisable that he run them for a short time in a warm dilute ammonia solution to complete the soap removal and follow with a warm water wash. If removal of soap is not complete, it will when allowed to react with the acid present in the dye liquor, decompose into its insoluble free fatty acid. This insoluble acid will adhere to the fibers and act as a resist to the absorption of coloring matter and therefore cause light colored streaks.

If grease is present it might be due to incomplete scouring, oil from drippings or from allowing the pieces to come in contact with oil from other sources due to careless handling on the part of operatives and it naturally will resist the absorption of coloring matters.

INTERFERENCE IN THE OPERATING OF THE DYEING MACHINE

To insure satisfactory results the pieces should at all times be in motion. At times, for various reasons, the machine ceases to operate while the goods are in the dye liquor. This might be due to the driving belt being too tight or too loose, slipping of the driving belt from pulley, breaking of belt or chain, if a chain drive is being used and a shut down of the power. If such occurrences do happen the winch should be turned by hand crank until power is restored, goods immediately cooled down by running in cold water, or removed from kettle at once and cooled down by treatment with cold water.

PRESENCE OF UNKNOWN CARBONIZING ACID IN THE PIECES

It is the practice in some establishments to color pieces

direct from the carbonization process which have not passed through a neutralization treatment. In such instances, the dyer allows for the acid present in the pieces when making up his dye liquor. If for any reason he is not aware of its presence and makes an addition of acid to his dye liquor, as for pieces free from acid, the resulting action will be a rapid absorption of the color due to the presence of an excess or possibly a too active acid and uneven shades will very likely be produced.

UNEVEN MORDANTING OF THE PIECES

Potassium and Sodium Bichromate are the most commonly used salts for the mordanting of wool and with due care very little trouble should be encountered when applying them. Many of the precautions, which should be taken when applying the acid dyestuffs should be given consideration when applying the mordant.

Special care should be taken when sulphuric acid is used in the mordanting liquor as this reagent causes a rapid breaking up of the chrome salt and is very apt to result in an uneven deposition of the chrome oxide on the piece.

Unevenly mordanted pieces will naturally absorb the mordant colors unevenly.

To prevent to a great extent crocking, due to the precipitation of free color lake in the piece, the mordanted pieces should be given a very thorough washing before applying the dyestuff.

CHROME TOPPING AT TOO HIGH A TEMPERATURE

It is advisable in most cases and especially so when heavy fabrics are being top chromed to cool down the dye liquor by the addition of cold water before making the addition of the chrome compound used for developing purposes.

The addition of the chrome to the hot acid dye liquor results in a somewhat rapid action on the part of the chrome and will possibly result in an unevenly developed shade.

In the case of heavy fabrics, the chrome is very apt to combine with the coloring matter or fibers on the face of the pieces and become exhausted before it penetrates, thus resulting in unevenly penetrated goods.

PARTIAL EXPOSURE AND DRYING OF CHROME MORDANTED PIECES

Chrome mordanted pieces should not be allowed to become partially dried out and especially if exposed to direct sunlight. Such an occurrence is very apt to happen when the pieces are piled up on trucks and allowed to remain any length of time before dyeing. It has been noticed that the exposed or dried portions have a somewhat different affinity for the coloring matter than the remaining portion of the pieces and when the coloring matter is applied to such pieces, uneven shades very often result.

UNEVEN STEAM DISTRIBUTION

Arrangements for the introduction of steam into the dye liquor should be of such a nature as to allow of a uniform distribution.

Steam is usually introduced through a false partition at the front of the kettle or from both sides. As before stated, the wool absorbs the dyestuff as the temperature rises and it can be readily understood that if the temperature of the liquor varies to any great extent in different portions of it, that an uneven absorption of the dyestuff will possibly result.

UNDER THE SECOND DIVISION A FEW OF THE CAUSES
WILL BE BRIEFLY DISCUSSED

Through ignorance of the intricacies of the dyeing operation or lack of co-operation, the supervisors of other departments do not realize that at times a change in the grade of stock, variations in the finishing operations or careless work in their respective departments interferes seriously in the production of satisfactory piece dyes and therefore the dyer should at all times be informed of any variation in the manner of handling the stock or goods.

MIXED WOOLS

It is a well-known fact that different varieties of wool vary to a slight extent in their affinity for dyestuffs. While this variation in affinity is only slight, it might be noticeable if different varieties are mixed and manufactured into cloth, which in turn is piece dyed light or medium shades.

PULLED WOOL

Wool which has been pulled from the skin of slaughtered sheep will, if piece dyed, show light colored or white specks. This is due to the fact that the roots of the fibers have much less affinity for coloring matter than the fiber proper.

KEMPS OR CHINESE WOOL

Kemps are wool fibers which have partially merged into hair and are very common in wool from the somewhat wild or undomesticated sheep of China.

Wool of such a nature has very little affinity for coloring matters and if for economic reasons it is mixed with a better grade of wool, it will show as light colored fibers in piece-dyed goods.

CARBONIZING STAINS

During the carbonizing of pieces with sulphuric acid, they are dried in the acid saturated condition. When in such a state, care should be taken that water is not allowed to come in contact with portions of the cloth. otherwise so-called carbonizing stains will result.

These stains are not as a rule noticeable on the white

pieces, but upon piece dyeing the goods, cloudy or uneven dyeings frequently result.

STRIPPED SHODDY STOCK

It is a frequent practice to remove coloring matter from shoddy stock by a treatment in a boiling solution of a mixture of sulphuric acid and di-chrome. Such a treatment results in the formation of chromic acid which in turn deposits chromic oxide on the wool fiber.

If a certain percentage of such a shoddy stock be mixed with pure wool and the mixture manufactured into cloth and piece dyed, specky shades are very liable to be obtained. This is especially liable to happen if the pieces are dyed with dyestuffs which produce different shade effects with chromed wool than with unchromed wool.

Furthermore, if all acid from the stripping operation has not been removed previous to scouring, insoluble soaps or free fatty acids will form which will interfere with the production of satisfactory shades.

INSOLUBLE SOAP

If hard water is used during the scouring operation or if the pieces containing soap come in contact with hard water, insoluble soap will be precipitated on the wool, which will prevent the uniform absorption of the dyestuff.

If undyed stock does contain this insoluble lime soap, a treatment in warm dilute hydrochloric acid will remove it to a great extent.

CARBONIZED STOCK

Stock which has been carbonized by the use of aluminum chloride contains a certain amount of aluminum oxide, which will act as a mordant for certain dyestuffs.

If such a stock is mixed with wool which has not been carbonized by this method, two shade effects will possibly result when the piece is dyed.

DELAY IN THE HANDLING OF WET PIECES

White or colored pieces should not be allowed to remain for any length of time between operations in a wet or damp condition, and especially so if in a warm state.

During the carbonization process the acid saturated pieces are at times allowed to become partially dried out.

Cloudy shade effects will often result if above-mentioned conditions are allowed to exist.

UNEVENLY SPUN YARN

Loosely spun yarn has a tendency to appear heavier in shade than tightly spun yarn, and therefore if unevenly spun yarn is employed for closely woven fabrics which are not to be milled to any extent, a somewhat unsatisfactory shade effect will possibly result.

HYGROSCOPIC MOISTURE

It is a well-known fact that wet pieces appear heavier in shade than do dry pieces. Pieces directly from the hot pressing operation are practically free from moisture and when exposed to the atmosphere for a short length of time gradually change shade due to so-called "cooling down."

This change in shade is seldom due to an actual cooling of the pieces but rather to the absorption of moisture from the air.

If the pieces are examined for shade before they have uniformly absorbed this hygroscopic moisture, they will very likely appear shady.

FAULTY FULLING OR MILLING

During the fulling of the pieces so-called wrinkles or folds form at times which are removed to a great extent during blow steaming. If the pieces are not subjected to this operation, it is with some types of fabrics a difficult matter to completely remove them and in many instances they are noticeable as off shade streaks in the finished piece dyes.

The formation of wrinkles is due principally to excessive pressure on the part of the upper roll of the scouring or fulling machines when the pieces are handled in the rope form, overloading the machines, improper balooning and by careless or irregular sewing of the ends.

UNEVEN NAPPING

The object of napping is to raise the fibers and thereby produce a nap on face-finished fabrics.

Wire napping is resorted to when handling fabrics manufactured from medium or coarse stock, while fabrics of finer stock are usually teasel gigged.

The production of an even nap depends to a certain extent upon a proper fulling of the pieces, for if they are not uniformly fulled the wires or teasels will not raise the nap as desired, and thin places are thus noticeable in the finished pieces.

Uneven napping is not necessarily due to unsatisfactory fulling but will result if too much moisture is present in the pieces, which condition will prevent to a certain extent the raising of the fibers during the teasel gigging and result in the formation of "gigg streaks."

Lack of moisture and uneven or bent wires will also have a tendency to produce an uneven nap.

UNEVEN SHEARING

If an uneven or irregular nap has been raised, it is practically impossible to produce a perfectly satisfactory finish and shearing of pieces of this nature will not result in the production of piece dyes of a uniform shade appearance.

Precaution should be taken during the shearing opera-

tion that the shear blade lies parallel with the revolving roll. Otherwise a shorter nap will be obtained on one side of the face, which will gradually increase in length towards the opposite side.

This very slight difference in the length of nap is oftentimes noticeable in colored pieces by the shading from a lighter to a darker tone.

CRABBING

This operation has for its object the softening, setting and in some instances a lustering of the fabric, and will, if not properly performed, produce results which will be noticeable in the nature of shady dyeings.

Upon passage of the piece through the machine special care should be taken that it is under uniform tension, for if otherwise, uneven shrinkage will take place the instant the piece comes in contact with the hot water.

Improper covering of the bottom rolls will result in a chafing of the pieces and is often the cause of watermarks and streaks.

Uneven steam pressure or circulation while the piece is being given a blow steaming is often the cause of dark colored selvage and a lighter colored shading towards the center of the piece.

The piece should be uniformly cooled, for a sudden cooling of portions of the piece while hot is oftentimes noticeable in the finished goods.

Steam should be free from water, dirt and oil.

If rolls are cooled in upright position dirt, if present, is liable to settle to the bottom of the roll.

BLOW STEAMING

The object of blow steaming is to set the nap and produce luster, and the operation varies with the finish desired and grade of stock.

Care should be taken when sewing the pieces to leaders.

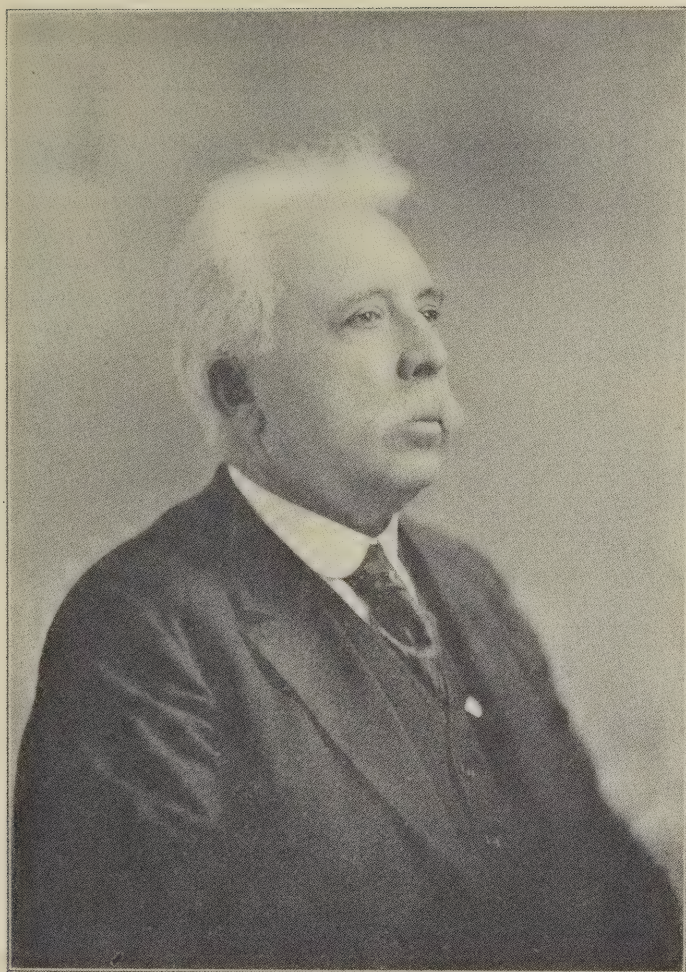
Uniform steam pressure and a uniform passage of steam through the roll should prevail, for if portions of the piece should be subjected to a more severe steaming than are others, dark or cloudy portions will be noticeable on finished goods.

Uneven circulation will result if the pieces are not central on lines, if not properly wound with cord or binding tape, if dry steam is not employed and if an uneven distribution of steam from the shell perforations take place.

The perforated shell should be properly covered so as to prevent the live steam from coming in more or less direct contact with the pieces and causing the appearance of perforation marks.

Precautions should be taken that the steam passage is uniform through the roll for if it is allowed to escape through the selvage portion or sides of roll, piece dyes will be produced which shade dark from the selvage to a lighter tone in the center of the piece.

(The end.)



MEN OF MARK in the DYESTUFF FIELD

Winthrop C. Durfee

**Consulting and Manufacturing Chemist
Boston, Mass.**

WINTHROP C. DURFEE was born in Fall River, Mass., April 23, 1858. Graduating from high school, where he showed great fondness for scientific studies, at the age of sixteen, he entered Brown University, taking chemistry as the major study, and graduated with the degree of bachelor of philosophy in 1878. On account of family interests he immediately entered the cotton-manufacturing business, and spent the next three years in the mills familiarizing himself with the various operations involved in the manufacture of cotton goods.

In 1883 he became representative in southern New England of the St. Denis Dyestuff & Chemical Company, of Paris, France, with which he remained for two years, and then entered the employ of Thomas Leyland & Co., where he remained for about a year. In 1886 he established himself as a consulting chemist with a primary purpose of testing dyes and chemicals for the textile mills. This soon, however, developed into the direct business of selling chemicals to these mills upon guarantee of strength, purity, or adaptability for special work. The problems that this business constantly presented called for careful study and research, which finally developed into an almost exclusive study of the application of mordant dyestuffs to wool.

Previous to 1880 the principal mordant dyestuffs used on wool were the dyewoods with some Alizarine Red, and the principles underlying the fixation of these mordant colors on wool with a chrome mordant were not generally understood. In the period beginning with 1890 Alizarine Blues came more and more into use and Hematine was introduced in a large way; hence the application both of Hematine and the newer Alizarines brought up new problems in mordanting that had not before been fully realized in the wool industry.

Believing from his observations that the dyeing of mordant colors on wool was a very complex problem, Mr. Durfee made a long and careful research into the conditions, both physical and chemical, that surrounded it. Among these was a careful study of the effect on wool dyeing of various organic acids, organic salts and compounds. He also studied very thoroughly the direct relation of chrome to the dyestuffs, and the conditions in which the sensitiveness of the various dyestuffs to oxidation, or conversely the necessity for some oxidation, played an important part; also the question of using the chrome mordants in very definite proportion to the dyestuff, rather than directly in proportion to the wool, as was the common practice, was carefully studied.

The result of these studies established Mr. Durfee as an authority on the dyeing of mordant colors. At the present time he maintains a large laboratory in order to continue the study of these problems. He is one of the councilors of the American Chemical Society, and is at present president of the Drysalters' Club of New England, a trade association composed of dealers in chemicals and dyestuffs.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

J. M. S.—Question—Will you kindly give me formulae for producing oxidized black on cotton hosiery with aniline oil and aniline salts? I should much appreciate the formulae in detail; and also please advise what change should be made in oxidizing mercerized stock.

Answer—In compliance with your request we have endeavored to obtain from various sources the methods actually in use for the production of aniline blacks. There seems to be no one process which can be accepted as standard. Each dyer appears to have worked out variations which suit his own particular conditions. We are giving below three recipes, all of which, we are told, will produce excellent results if carefully followed. It is up to the individual dyer to determine what process will best fill his needs. In general, there is no change to be made for oxidizing mercerized stock. For further information on this subject we call your attention to the special article, entitled "The Application of Aniline Black to Cotton," which appears elsewhere in this section of The REPORTER. The recipes in question follow:

Dyeing Aniline Black on Cotton—(Recipe for 1,000 pounds cotton.) Prepare the bath as follows: Dissolve thoroughly 6 pounds soda crystals; add the whole solution to the boiling kier. Enter the goods and boil between two and three hours, until the goods are thoroughly boiled through. Leave in this liquor during the night. The morning following take out and whizz dry. They are now ready for dyeing.

(For a 40-gallon barrel.) (1) Dissolve 2 pounds tartaric acid; (2) dissolve $5\frac{1}{2}$ pounds chlorate of potash, 4 pounds bluestone and 4 pounds sal ammoniac; (3) dissolve and thoroughly mix together 15 pounds aniline oil and 11 pounds muriatic acid. Add the quantities of Nos. 1, 2 and 3 to form the mother liquor. Add these in succession, starting with No. 1. When thoroughly stirred, test the liquor, which should have a strength of 11 or possibly 12 deg. Tw. Now take sufficient of this liquor to make up the dye bath, which should be a strength of $7\frac{1}{2}$ deg. Tw. This bath can always be kept up, and the most economical way is,

after the goods are put into the whizz, to catch the liquor which will run out and add it to the dye bath, and then add sufficient liquor from the barrel to again make the strength, as formerly, $7\frac{1}{2}$ deg. Tw.

Now immerse the goods in this liquor for twelve minutes, take out and thoroughly whizz. Then enter the goods into an oxidizing machine (the O. & P. Rothe machine is a good one) and oxidize four or five hours at about 110 deg. Fahr. Then remove from the oxidizing machine and enter the same into the developing bath, which make up as follows: Dissolve 5 pounds bichromate of potash and 1 pound soda crystals. Enter the goods at 160 deg. Fahr; lift, wash and soap lukewarm.

* * * *

Aniline Black with Copper Sulphate—This recipe gives a fast to bleaching aniline black on yarn.

Use wooden or stone vessels throughout; no metal must be present. Dissolve 60 parts aniline salt in 320 parts water, and make perfectly neutral, if necessary, by addition of aniline oil; $2\frac{3}{4}$ parts copper sulphate in 50 parts water; 19 parts sodium chlorate in 37 parts water; 2 parts ammonium chloride in 12 parts water; 24 parts aluminium acetate, 15 deg. Tw.

Mix together and the resulting liquor will stand about 12 deg. Tw. Pad the yarn in this liquor 2 pounds a time and wring out so that it holds its own weight of liquor. Dry in a stove at 95 deg. Fahr. (35 deg. Cent.) on sticks which have been saturated with the above liquor in order to avoid stick marks. Turn the yarn every two hours (the workman must have dry hands; wet hands will make finger marks). When dry let steam into the stove till the dry bulb shows 95 deg. Fahr. (35 deg. Cent.) and the wet bulb shows 86 deg. Fahr. (30 deg. Cent.). Keep at this temperature for six hours, by which time the yarn should have turned to a dark bottle-green. Chrome quarter of an hour at 180 deg. Fahr. (80 deg. Cent.) with 4 per cent bichrome and 1 per cent sulphuric acid, which treatment turns the yarn to a jet black; wash off, and finally soap quarter of an hour at 180 deg. Fahr. (80 deg. Cent.).

* * * *

Aniline Black with Copper Sulphide—Copper sulphide in the form of a paste is used as the oxygen carrier, and is made by the double decomposition of copper sulphate and sodium sulphide, as follows: $37\frac{1}{2}$ parts copper sulphate are dissolved in 150 parts of water, to which are added 39 parts sodium sulphide crystals in 100 parts water. Filter and press the paste till it yields 54 parts, in which concentration it is used. Fifteen parts aniline salts made neutral with aniline oil; 5 parts copper sulphide paste; 5 parts sodium chlorate; 75 parts water.

The strength of the padding liquor is determined by the quality of the cloth. The cloth should be so squeezed that it retains its own weight of padding liquor. The cloth is dried, given a three-minute passage through the ager at 140 deg. Fahr. (60 deg. Cent.),

then chromed and soaped. The black may also be developed by hanging, when it naturally takes much longer but the danger of tendering is greatly minimized.

Review of Recent Literature

"Color and Its Applications." M. Luckiesh. 431 page, 6x9¼; 150 illustrations; 4 color plates; 34 tables; cloth, \$4.50. New York, D. Van Nostrand Company.

This is the second edition, enlarged, of this interesting and useful work on the theory of color application. A number of changes from the original text have been made for this new edition and an extensive chapter giving much useful data and methods for their use has been added by the author, who is director of applied science at the Nela Research Laboratories, National Lamp Works of the General Electric Company. The contents include: Light; The Production of Color; Color-Mixture; Color Terminology; The Analysis of Color; Color and Vision; The Effect of Environment on Color; Theories of Color Vision; Color Photometry; Color Photography; Color in Lighting; Color Effects for the Stage and Displays; Color Phenomena in Painting; Color Matching; The Art of Mobile Color; Colored Media; Certain Physical Aspects and Data.

"French-English Dictionary for Chemists." Austin M. Patterson, Ph.D. 384 pages, 5x7; flexible "fabrikoid" binding, \$3.00. New York, John Wiley & Sons; London, Chapman & Hall; Montreal, Renouf Publishing Company.

This book fills a long-felt demand for a companion volume to the same author's "German-English Dictionary for Chemists," which has proved useful to many chemists both here and abroad. In the new work the plan of the earlier book is followed. A list of abbreviations is given, together with an introduction and a valuable article on "The Conjugation of French Verbs." Standard works of reference have been carefully studied by the author, and opinions have been obtained from several experts in the endeavor to produce a book of value, and there can be no question of the fact that this work will assist the research man to get at facts in original text which might otherwise elude him. The contents include a preface, abbreviations, introduction, conjugation of French verbs, general statement by Prof. Frank Vogel, active voice (and intransitive verbs), passive voice (conjugation of *etre*), reflexive verbs, and the French-English dictionary (A to Z).

"Dyeing Silk, Mixed Silk Fabrics and Artificial Silks." A. Ganswindt; translated from the German by Charles Salter. 228 pages, 5½x8¾; cloth, \$5.00. New York, D. Van Nostrand Company.

This work contains a thorough discussion of practical methods used in the dyeing of silk, and the text, being based on an experience of more than twenty years, covers the subject in a really comprehensive manner, so that in the hands of the silk dyer as well as the novice it should be found helpful. The contents include an introduction and chapters devoted to silk, tussah, wool-silk, half-silk fabrics, and artificial silk.

This department has received from the Will Corporation, manufacturers of glassware, chemicals and laboratory apparatus at Rochester, N. Y., two trade catalogues worthy of note under the titles "Water Stills" and "The Ion-O-Meter," respectively. The first is conceived, the foreword states, in the belief that since a firm must advertise its goods, the process might as well be made worth while and of real service to its present and prospective customers, and this idea is well carried out in the manner in which the general subject of water stills is thereupon treated in the pages following. The varying degrees of purity demanded of distillates for different purposes are noted and the various types of stills described. Descriptions of the company's products follow. The ultramodern touch, we cannot refrain from mentioning to eager readers, is to be found in the blank affidavit, perforated so that it may readily be detached, requiring the intending purchaser to S.S.—or words to that effect—"that the distilling apparatus required by me, and for the purchase of which I am now negotiating, is to be used exclusively for the distilling of water. . . ." Alas! The second catalogue describes the Elliott Ion-O-Meter, which, it is claimed, will fill the need for an apparatus simple, rugged and accurate enough to make possible the application of the electrometric method to the everyday problems of the plant and research laboratory. An example of the work performed by this apparatus is the following: "Supposing it is required to determine the acidity of a tan liquor, it is only necessary to place a few ml. in the Ion-O-Meter, drain a bit from a convenient stopcock, thus making the liquid junction; turn on hydrogen gas for a few minutes and take the voltage from an electrical instrument whose compactness and ease of operation are surprises to those used to the old-fashioned potentiometer and galvanometer set-ups. The voltage is converted into acidities by reference to a table." The Will Corporation is to be commended for the straightforward manner in which it discusses general problems of laboratory practice without too great an obtrusion of its own apparatus, which is confined to a separate portion of the catalogue.

AMERICAN DYESTUFF REPORTER

MONTHLY TECHNICAL SECTIONS

VOLUME 9

1921

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AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 9, NO. 1
JULY 4, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

In an article entitled "The By-products of Wool Scouring" John W. Russell, B.T.C., describes the latest method for recovering wool grease by means of the centrifugal separator.

Frederic Dannerth, Ph.D., outlines the present use of dyes and other coal-tar products by the rubber industry and suggests that there is a wide field for the development of dyestuffs as substitutes for the earth pigments now commonly used for coloring rubber goods.

Dorothy N. Burbeck, B.T.C., gives some valuable suggestions concerning the need for cleanliness in the dyeing laboratory.

In an address delivered before the South of Scotland Section of the British Textile Alliance, D. K. Colledge describes the common faults in fabrics due to chemical causes and suggests means for their elimination.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 9, No. 1

NEW YORK, JULY 4, 1921

Section 2

The By-Products of Wool Scouring

Historical Sketch of Wool Scouring—Development of Modern Machinery—Classification of Wool Impurities—Recovery of Wool Grease—The Acid-Cracking Method—The Centrifugal Method

By JOHN W. RUSSELL, B.T.C.

(All rights reserved.)

THE cleansing or scouring of wool, as a step in the manufacture of a woolen or worsted fabric, is one of the oldest of the textile processes and a distinctly influencing factor in the quality of the finished goods. In spite of this fact, nevertheless, when its history and development are studied it is apparent that, in comparison with other operations, it has received relatively less research than its importance would seem to warrant—and this applies especially to work along lines pertaining to the recovery and use of the valuable by-products connected with the industry, the most important of which are potassium compounds and wool greases.

Indeed, to the casual observer there might seem to be but a limited field for scientific investigation in the mere passage of wool through a bath of soap and water, and the subsequent treatment of the resultant liquors for the greases, etc., contained in them; but when the subject is viewed from a technical standpoint, it is readily seen that the difference between success and failure oftentimes lies in an understanding of the fundamental chemical and physical principles underlying the processes—hence the value of research. However, this article does not aim to discuss specific details of the work, but rather to give a brief account of the development of scouring, together with a general description of the by-products, their recovery and uses.

DEVELOPMENT OF WOOL SCOURING

Historically, the development of the process is interesting, as its origin dates back many centuries. In the early days of cloth making it was the custom to pile the wool on the banks of running streams and work it by hand in the cold water. This, of course, removed only the sand and loose impurities, and in

no way cleansed it of the adhering wool greases. Later, saponaceous herbs and barks were used as aids, and finally, when soap making was discovered, a fairly clean product was obtained by the use of soap and warm water. Even then, however, the work was slow and the results none too good.

Next came primitive forms of apparatus for washing and rinsing—which usually consisted of vats or tubs for holding the wash liquors, together with draining shelves or rinse boxes attached. Some of them were supplied with crude lever presses for expressing the liquor from the mass of wool, while in other cases it was rinsed by simply throwing clear water over it as it lay on the draining shelves or on the floor.

From these crude methods and appliances the modern mechanical scouring machinery has been gradually evolved, until to-day we see a volume of work accomplished which would have seemed impossible to the millman of fifty years ago. Nowadays the wool is fed into a train of tanks or "bowls" (usually three) and worked in the liquor by means of slowly moving forks. Each bowl contains either clear water or soap solution, maintained at the proper temperature by means of steam pipes, and a pair of squeeze rolls that remove all the surplus water or liquor from the wool as it passes from one bowl to another, or from the end of the train. In this manner it is cleansed with a minimum of agitation—a factor much desired, as excessive handling in a warm, alkaline bath tends toward felting and the production of fibers having a harsh, unkind feel.

IMPURITIES ACCOMPANYING RAW WOOL

The various impurities found in raw wool are so well known and have been described in so many books pertaining to textile work that it seems unnecessary

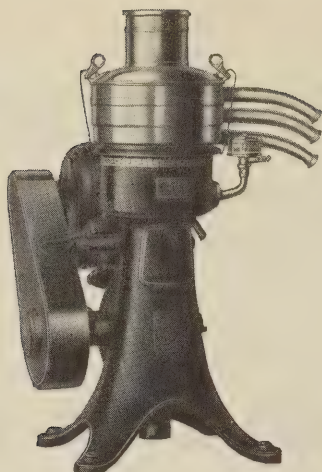


FIG. 1—A De Laval Separator for Recovering Wool Grease from Scouring Liquor

to give a detailed account of them in an article of this kind, but for reference the following table (from *Textile Chemistry and Dyeing*, Olney) is reproduced, as it shows very clearly the wide limits within which they occur.

	Per Cent
Moisture	4 to 30
Combined yolk and suint.....	12 to 47
Actual wool fiber.....	15 to 72
Mechanical impurities and dirt....	3 to 24

The "suint" is the so-called perspiration or "water-soluble" impurity, while the wool greases constitute the "water-insoluble" portion; together they make up what is termed the "yolk."

Because of the potassium salts it contains, the suint is of economic value and for many years plants in Germany, Belgium, France and other Continental countries have used the liquors for the recovery of these salts, as well as for the grease occurring with them. From the first crude attempts many interesting processes have developed, several of which have been brought to a fairly high state of perfection and are protected by patent rights. The chemical composition of the suint varies widely but, in general, it may be said to consist of the potassium salts and soaps of oleic, palmitic, stearic and acetic acids, together with smaller amounts of their ammonium compounds. In many cases there are also present potassium salts of some of the mineral acids—principally hydrochloric and phosphoric.

In cases where it is the practice to give the wools a preliminary treatment by lixiviation with warm water, a good deal of potassium carbonate and smaller quantities of other potassium salts are obtained from the waste liquors coming from the vats. Usually they are run into multiple effect evaporators and brought down to dryness to yield a hard magma or residue. This is calcined in a reverberatory furnace, to drive off all forms of organic matter, and the resultant ash extracted with water to dissolve out the salts. This

liquor gives on further evaporation and calcination a very good grade of potash. While, naturally, the yields vary considerably with the different types of wools used, in many cases the value of the products obtained exceeds the cost of the process—especially where waste heat can be used for the evaporations, etc.

The "water-insoluble" or greasy part of the impurities has been studied to some extent, but there seems to be considerable room for research concerning its composition and potential usefulness after recovery. From the term "wool fat" or "wool grease" many have the mistaken impression that it is a true grease or glyceride. Such is not the case, however, as it belongs to that class of complex chemical substances known as waxes, and consists, for the most part, of salts of certain higher fatty acids in combination with some of the higher alcohols, such as cholesterol and its isomer—isocholesterol. Cholesterol is generally recognized as having the formula $C_{26}H_{43}OH$ and, together with its compounds, forms a class of substances which are remarkable for two outstanding properties—first, the ease with which they are emulsified and, second, the great difficulty encountered in saponifying them. This latter fact explains the trouble often experienced in completely cleansing wool of all impurities by the use of a bath which, of a necessity, must contain but very small amounts of alkali. An idea of the great resistance to saponification shown by pure cholesterol may be gained by a consideration of the fact that it can be boiled for several hours with strong alcoholic potash without being completely saponified. Its action in the scouring bath is wholly one of emulsification. It occurs in the largest quantities in certain parts of cattle and sheep, and is sometimes isolated in the pure state for use in medicine from these sources. The writer has obtained it from crude wool grease by alcoholic extraction, but its preparation from this source is attended with considerable difficulty.

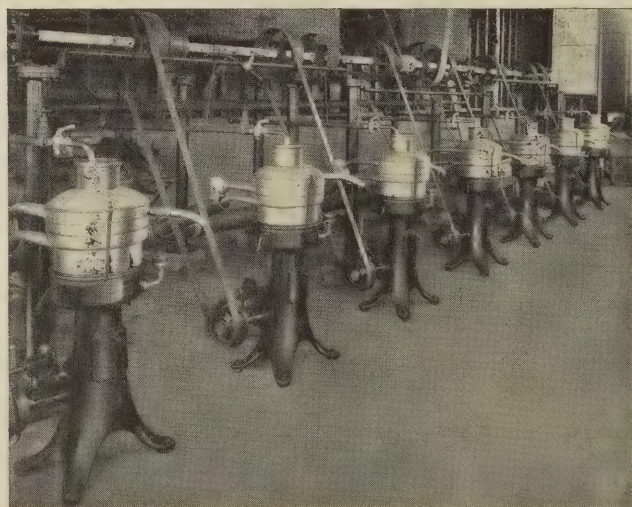


FIG. 2—Battery of De Laval Separators Installed in a Wool Scouring Plant

RECOVERY OF GREASES FROM SCOURING LIQUORS

As in the case of the potassium salts, processes for the recovery of the grease content of the liquors were first worked out abroad, but now a number of plants in this country are finding it profitable to utilize them for this purpose. Another influencing factor is the enforcement, in many localities, of laws prohibiting plants from discharging wash liquors into sewers or streams without first rendering them less obnoxious. This may be done without recovering the greases for commercial purposes, but many concerns have found it possible to turn this further handling into an asset rather than an addition to their overhead expense. While it requires some outlay for the proper equipment to produce a marketable grease, where conditions are right the expense can be fully justified and another step taken toward the utilization of one more waste product.

There are essentially two methods—the old “acid-cracking” and the newer centrifugal process, together with many modifications and combinations of both. The “acid-cracking” process has been used in England for many years for the recovery of the so-called “Yorkshire grease,” and depends upon the breaking up of a grease and water emulsion by the addition of dilute acid. The liquors are run into large vats (usually brick-lined) and treated with dilute sulphuric acid until the mixture becomes faintly acid, at which point the emulsion breaks or “cracks” and the greases rise to the top, whereupon they are either skimmed off, or the broken emulsion may be run through vats provided with cinder bottoms, which retain the greasy portion but allow the water portion to pass through.

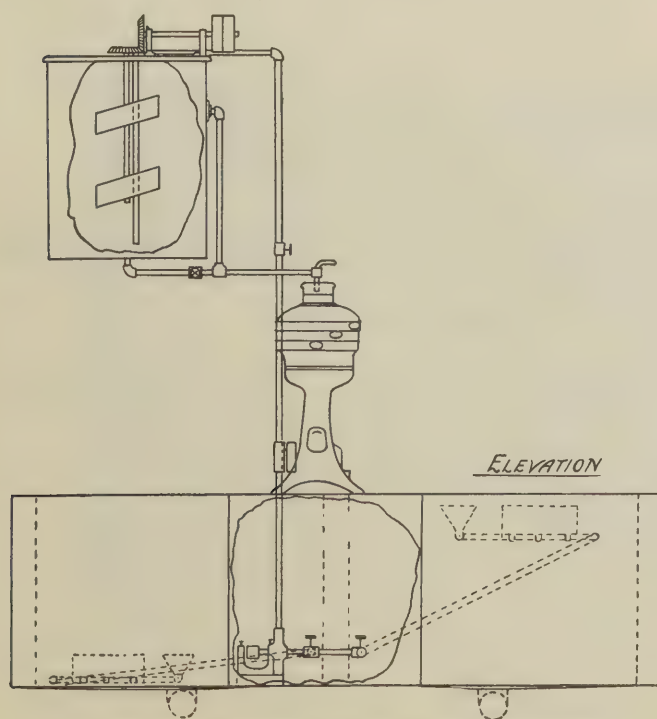


FIG. 3—Elevation of Separator Installation

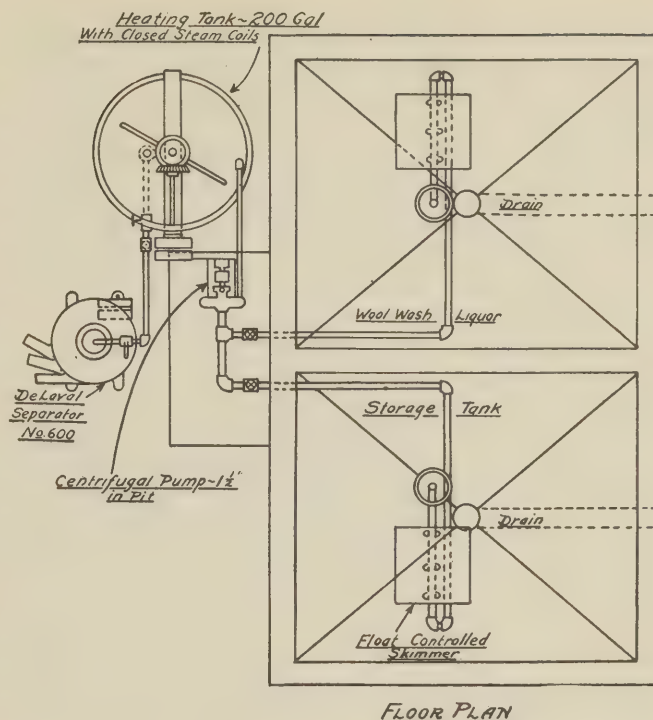


FIG. 4—Floor Plan of Wool Grease Recovering Plant

The effluents coming from these vats are generally sufficiently purified to be run into streams. The greasy sludge is then hot-pressed and the resulting clear grease run directly into barrels. Great quantities are distilled with superheated steam for the production of the well-known “distilled grease oleins” and “stearins”—the former being used for oiling coarse grades of wool, and the latter, in conjunction with other greases, as a lubricant.

This old “acid-cracking” method, with its ponderous filter beds and steam presses, which required much labor to handle and large boiler capacity, has been superseded, to a great extent, by the newer centrifugal methods, which make use of machines built along lines similar to the familiar cream separators but adapted to the handling of large quantities of liquors per hour. A battery of machines will take care of an enormous quantity of scouring liquors and will produce a marketable grade of grease with a comparatively small amount of power equipment, floor space and labor. A machine like the one shown in Fig. 1 has a capacity of 500 gallons of liquor per hour on $1\frac{1}{2}$ horse-power, and in a well-arranged plant one man can care for and operate five such machines. Fig. 2 shows a battery of separators in such a plant.

Figs. 3 and 4 show diagrams of the storage tanks, heating tank and separator in a small, typical installation so arranged as to insure the best results. When the storage tanks are below the separators, as shown in the elevation (Fig. 3), a centrifugal pump with liberal capacity for the number of separators to be supplied is connected with the two swinging pipes which drain off the liquor at the surface. These pipes

are provided with stops or legs which prevent their sinking into the sludge at the bottom of the tanks, together with valves so situated that the suction of the pump can be controlled from either of the tanks as desired.

The discharge from this pump leads to the heating tank, which may be constructed of wood or steel, and in which the liquor is heated to a temperature of from 190 to 200 deg. Fahr. by means of closed steam coils around the sides of the tank. A mechanical agitator constitutes part of this heating equipment, in order to insure the greatest heating efficiency. The outlet from this tank leads to the separator (a De Laval in this case) and is shown well up on the side of the tank. Through this the heated liquor flows to the separator, at the same time maintaining a uniform quantity of liquor in the tank, the quantity being sufficient to avoid exposing the heating coils, with a consequent loss of heat. When it is desired to empty the heating tank completely the outlet at the bottom is used.

The object of the two storage tanks is that each may be used alternately, thereby permitting skimming the liquor as soon as possible after it is drawn from the scouring bowls; and the object of the swinging or float-controlled pipes therein is to insure the longest possible settling periods for the liquors.

The action of the separator itself on the liquors is rather interesting. Advantage is taken of the difference in specific gravity between the grease and water, and the action of centrifugal force on the emulsion. The liquor enters the top of the machine through a central feed tube, then passes downward through a device which distributes it in thin layers between a series of discs, where it is subjected, in strata, to the powerful centrifugal force generated by the revolving speed (about 600 r.p.m.) of the bowl. The water, being heavier than the grease, is forced to the periphery of the bowl and is led off to one of the spouts, while the grease is collected near the center and car-

ried off through another spout. In many cases the grease is dry enough as it comes from the machines, but where the requirements are strict it can be run into vats and heated until the moisture content is sufficiently reduced. The waste water flowing from the machines may be run into sewers or streams without further treatment.

USES OF WOOL GREASE

The utilization of wool grease offers a considerable field for research and, while a good deal has been done on it, new opportunities for its uses are continually occurring. At the present time, most of it is used in the leather industry (for softening, etc.), some for lubrication work, and in the manufacture of lanolin, together with a few other minor uses.

In making lanolin it is worked up to a high degree of purity, and one would scarcely recognize it in this form. At the start of the process it is a dark, evil-smelling substance, but when refined, bleached and deodorized it is put on the market as a cream-colored, highly unctuous preparation, with but a very slight, rather cleanly, odor.

Lanolin is used in large quantities as a basis for ointments, pomades and cosmetics, because of the fact that it does not become rancid, will absorb large quantities of water (up to more than twice its own weight) and is very readily taken up by the epidermal tissues. It is recognized by the pharmacopoeias of several countries and should conform with purity standards before being put on the market.

Formerly most of it used in this country was imported from abroad, but now there are plants here engaged in its manufacture. The writer has had occasion to test both foreign and domestic samples, and has found that some of the American products compare very favorably with, and in some cases surpass, the foreign products in regards to purity.

The Rubber Industry as a User of Dyes and Coal-Tar Products

A Discussion of the Present Use and Possible Future Employment of Coal-Tar Products by the Rubber Industry, Particularly as Regards the Substitution of Dyes for Pigments as Coloring Matters

By FREDERIC DANNER, PH.D.

The Rubber Trade Laboratory, Newark, N. J.

(All rights reserved by the author)

THERE are three principal points of contact between the maker of dyes and the manufacturer of rubber goods. The first and obvious case is that in which a fabric of cotton, wool or silk is dyed uniform-

ly in the piece, or the fabric is woven out of yarns that were dyed separately, or the woven fabric has had a design printed on it. These colored fabrics are then used in the manufacture of rubberized or rubber-coated fabrics

in the making-up of footwear, automobile tops, raincoats and ice bags

DYED TEXTILE FABRICS

The use of colored textile fabrics in the making-up of rubber goods was discussed in the AMERICAN DYESTUFF REPORTER (November, 1920) by Henry J. Thompson. In that article it was pointed out that the firms which dye fabrics for use in the manufacture of raincoats, automobile tops, and footwear ought to give serious attention to these points:

1. The dyeing must not impair the strength of the fabric.
2. The dyed fabrics must be free from any chemicals that may develop during the vulcanizing process, into compounds that would weaken, attack, or destroy the fabric.
3. There must be no variation in shade of fabrics dyed at different times.
4. The goods must be dyed so thoroughly that good penetration is obtained.

In one process of vulcanization the sulphur is mixed in with the rubber compound and this compound is then applied to the fabric on a hot friction calender, or the compound is thinned down with gasoline and applied to the fabric on a spreader. If the compound contains sulphur as in the instance just cited, the coated goods are cured or vulcanized in a heater or autoclave, and the dyes used must stand the temperature of vulcanization. If the compound contains *no* sulphur, the vulcanization of the rubber compound is effected by exposing the goods to vapors of sulphur chloride in a closed chamber, at more or less elevated temperatures. This vapor cure does not affect the dyes as strongly as does the heat of the autoclaves.

The second case is that in which a finished rubber

product is merely dyed by immersing it in a water solution of the dye at temperatures slightly above 100 deg. Fahr. A familiar example of this is the coloring of toy balloons. A modification of this process consists in using "gasoline soluble dyes." In this case the solution of the dye in gasoline is added to the rubber cement. The forms are dipped in the thin cement, the gasoline is evaporated and the form is then dipped in the sulphur chloride bath. By the use of this process, a very wide variety of effects may be produced on the balloons.

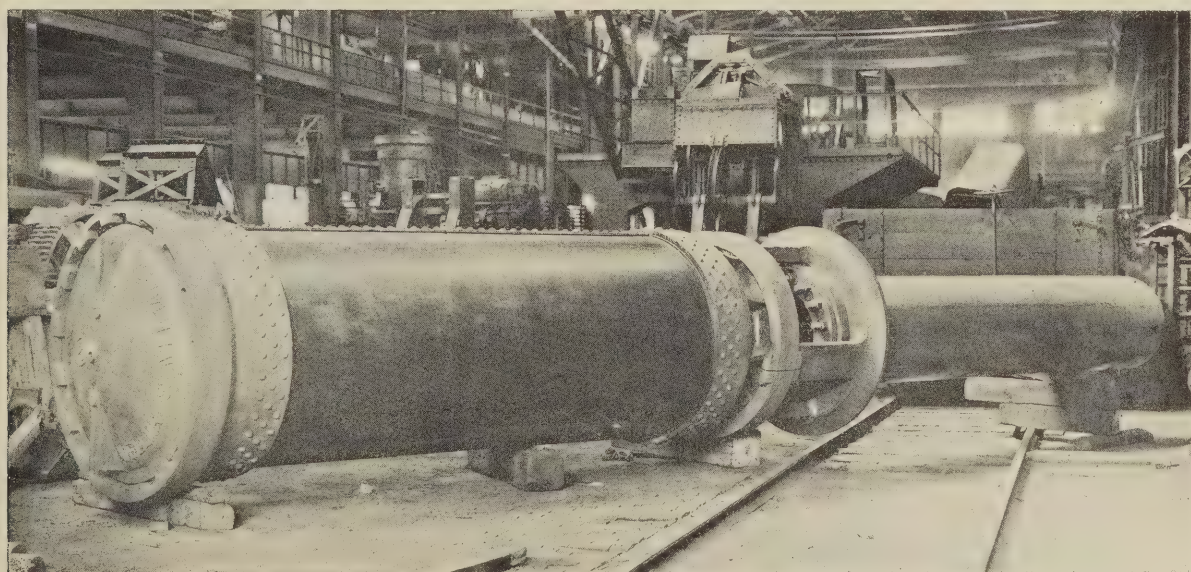
DYES WILL REPLACE MINERAL COLORS

The third case and one which is least common is that in which a dye is mixed in with the rubber compound directly on the mixing mill, in order to displace the mineral pigments. Either a dye or a lake may be used for this purpose, but the later processes will decide whether or not the correct dye or lake has been chosen. The rubber compound may be vulcanized in any one of the following ways: (1) In an autoclave heated with open steam pipes; (2) in an autoclave heated with closed steam pipes; (3) in a vacuum heater; (4) in a platen press, between plates heated by superheated steam at temperatures around 300 deg. Fahr.; (5) in a vulcanizing chamber by exposure to the vapors of sulphur chloride; (6) by dipping the product in a solution of sulphur chloride.

The rubber compounds containing these dyes or lakes may be used in the manufacture of matting, tiling, druggists' sundries, mechanical goods (belting, hose and packing), footwear, automobile covers, raincoats, hot-water bottles, garden hose, bicycle tires and a host of other things.

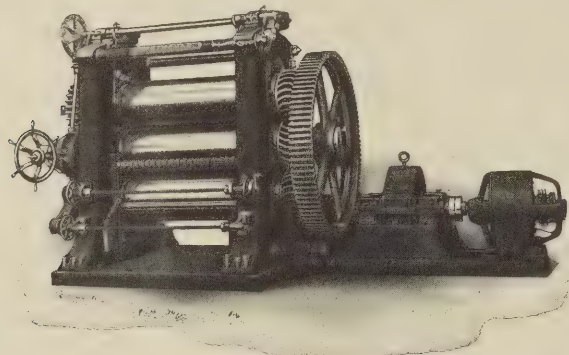
MIXING COLLOIDS WITH RUBBER

Investigations conducted during the past five years in



Vulcanizer Used for Auto Tires, Shown Lying on Its Side. This Is Placed So That Its Longest Dimension is in a Vertical Position. The Top of the Machine Is On a Level with the Loading Platform When the Machine Is Installed Ready for Use

rubber goods factories indicate that there is an advantage in mixing substances with rubber while they are in the colloidal condition. One example of this is the admixture of glue pastes or glue jellies with rubber, in the rubber washing machine. Another instance of this is the incorporation of mineral substances with the washed rubber, and precipitating the insoluble compound in finely divided condition throughout the rubber. All this



Tire Calender and Drive

tends toward a rubber compound containing the ingredients in an extremely fine state of subdivision. And so the thought arises, whether or not it would be feasible to treat the rubber with certain coal-tar products while they are in solution. It is, for example, well known that rubber loses much of its tensile strength and other physical properties when it is converted into cements by gasoline or benzol.

An investigation of coal-tar dyes used in the rubber industry shows that the use of these products for coloring rubber is extremely limited at this time. This is not due, as one might suppose, to the fact that these color matters are not suited for this purpose, but rather to the fact that little or no attention has heretofore been given to the matter.

A certain number of domestic dye manufacturers have taken up the manufacture of the simplest amino *accelerators* used for vulcanization. But the problem of finding suitable *colors* to replace the mineral pigments has, it would seem, been deemed unworthy of notice.

MINERAL PIGMENTS NOW IN USE

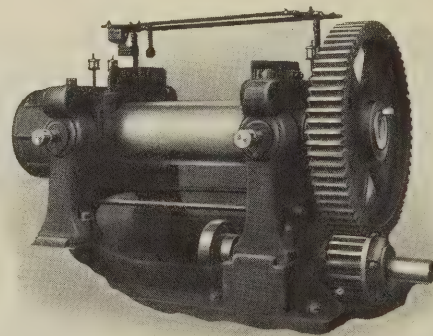
If we stop for a moment to consider the mineral pigments now used for coloring rubber products, we will find that the compounder uses red oxide of iron, crimson antimony sulphide, golden antimony sulphide, chrome yellow, chrome green, ultramarine blue, as well as yellow ochre, burnt sienna, burnt umber and vermilion. Here is a series which covers almost the entire spectrum and they are needed, many of them, in the manufacture of rubber goods for decorative as well as useful purposes. The dove-tailed floor tiling, the blue hot-water bottle, the green auto inner tube, the red steam packing, all these are made possible by these pigments. Why, then, should not the maker of dyes look into this market for his goods? To be entirely correct, he has, in some cases,

For example, I might cite the case of the fancy bathing caps seen at our watering places and shore resorts. These weird marbled effects are secured by the aid of dyes. Then again we will find them used in the coloring of toy balloons. In these two cases the rubber used is virtually a "pure gum." The extreme elasticity demanded of toy balloons and bathing caps precludes the use of large quantities of fillers. With this in mind, the maker of toy balloons makes his product and vulcanizes it entirely before he finally applies the color to it. The dyeing process is then the next step and this is carried out by immersing the finished balloons in a water solution of the dye.

RESEARCH IN EUROPE

Rudolf Ditmar, head of the Rubber Trade Laboratory in Graz, Austria, reported three or four years ago on the subject of coal-tar dyes and pointed out that they are generally unsuited for coloring rubber compounds. This is especially true if the compounds are to be vulcanized in open steam or in dry heat, because they do not withstand the high temperatures used in those processes (about 300 deg. Fahr.). It will be recalled that toy balloons and bathing caps are vulcanized by the cold cure, and this involves dipping the rubber product in a solution of sulphur chloride thinned down with gasoline or carbon tetrachloride. In certain other cases as, for example, in the vulcanization of the rubber compound on rubberized or rubber coated goods, the coated fabric is exposed in a chamber to the vapors of sulphur chloride. This is known as the vapor cure.

Ditmar found that the vat dyes, that is the dyes related to indigo, actually withstand the peculiar conditions found in vulcanization, and he has with the aid of these vat dyes produced a variety of useful colors in



Standard Rubber Mill

rubber goods. He found among other things that dyes like the anthra-quinone derivatives which contain "reversible groups" are eminently well adapted for these purposes.

The idea of producing insoluble, colored diazo compounds directly in the rubber compound was patented about seven years ago. The obvious experiment is to incorporate an amino body with the rubber. The amine is

then diazotized by sodium nitrite in acid solution. In this way para-nitranilin red can be formed in rubber as a brilliant red lake in a fine state of subdivision. Now this last named point is of considerable importance because rubber chemists are gradually coming to realize that the "state of subdivision" of particles in a plastic mass is of considerable import. It is this factor which influences to a great extent the property of toughness, strength and life of the compound.

A WIDE FIELD FOR MANY COAL-TAR PRODUCTS

Up until the present moment rubber chemists have looked to the coal-tar industry to supply them with amino derivatives suitable for use as accelerators of vulcanization, but I am firmly of the opinion that they will, during the coming years, consider also the possibility of using many other derivatives of coal tar. Hexamethylene tetramine, beta-dinitro-anthraquinone, diphenylthiourea, and tetra-methyldiamino-diphenylthiourea, monaphenyl-guanidine, phenyl mustard oil, and many other compounds have been prepared on a more or less extensive scale for the rubber industry up the present time.

A very large number of dyes have been prepared from coal tar and a high percentage of these have been found unsuited for use in coloring textiles of cotton, wool and silk. Although we have at present admitted approximately 1,000 dyes to consideration in textile dyeing, it is safe to say that the number of dyes thus far prepared or whose formation is possible numbers around 100,000. The difficulty has been that many are not fast to light, while many others are not fast to laundering. In the application of these two primary tests a large number of new compounds are discarded even though they are dyes in the usual sense of the word.

Now it is quite possible that many of these coal-tar derivatives which can be prepared at a relatively low cost would be valuable substances in a rubber compound. We know at this time that the mon-amino, diamino, tri-amino, and tetramino derivatives of many benzol compounds are valuable as vulcanization accelerators, but we do not know much about any other group or division of derivatives. Here is an opportunity for scientific research which will find quick application in the rubber industry, if tangible results can be shown. Only a few "leads" will be necessary, because the American rubber industry has back of it a large number of experienced, college trained, chemists, who are alive to the possibilities of any new compounding materials.

If we stop for a moment to consider the variety of derivatives now available we will find the chlor-benzenes, oxy-benzenes, nitro-benzenes, amino benzenes, sulphonic acids of benzene; then the corresponding derivatives of naphthalene and anthracene. There are compounds related to phthalic anhydride, and others which contain the azo group. The insoluble azo colors, aniline black and indigotin, all these products have yet to be examined with reference to their possibilities in rubber compound-

ing. Who will say that the naphthols and the amino sulphonic acids of naphthalin are suited or not suited for imparting valuable properties to rubber mixtures? Who will say that they are not valuable when used in the proportion of one-half per cent in a recipe? In the year 1919, there were imported into the United States 536,000,000 pounds of raw rubber and this when turned out in the shape of manufactured rubber goods must have amounted to at least 1,111,000,000 pounds. If coal-tar derivatives were to form but 1 per cent of this last-named figure, the American dye manufacturers would be assured of a rather substantial market.

CLEANLINESS IN THE DYEING LABORATORY

Important Advice for the Student of Textile Coloring,
and Perhaps for Some Who Have Passed
the Student Stage

By DOROTHY M. BURBECK, B.T.C.

THIS is not any new idea on the advantage of cleanliness in the dyestuff laboratory, for surely all realize the absolute importance of it, but is instead a reminder for those who have become slack in their methods, and may have taken few if any measures to improve them, and yet are wondering why they do not obtain better results, or what is more important, the correct results.

Personally, I think we cannot overestimate the value of cleanliness in the dyestuff laboratory, whether it be in one of an actual manufacturing concern, or in some technical school. If in the latter case more stress should be laid upon this matter less improvement would have to be made and less constant watch kept when the man gets into the laboratory of the real business world.

In experimental or research work, care must be taken that only scrupulously clean apparatus is used; and of all apparatus, the balance should be most carefully watched, for that is the keystone of perfect work with dyes. To be sure, the purity and quantity of reagents used are vital, but any imperfections of or contaminations from the scales employed, be they ever so minute, will certainly produce disastrous or at the least, extremely misleading results. To many "close enough" seems to be the idea. There is where you make your greatest mistake. Chemistry is fundamentally an exact, a particularly exact, science, especially when dealing with any experimental dye investigation, so there cannot possibly be any such condition as "close enough"—your work is either right or wrong. Yes, I know you may get away with it now—may do so for a time—but what is the ultimate gain? Some find more satisfaction in "getting away with it" than in getting it right. To me it seems far easier to start right and know what you are doing than it would to carry out the work in a careless, slipshod manner, with one eye on the instructor or the department head for fear he may observe your methods and correct them or warn you against your carelessness. If you leave your technical school and start out in a business laboratory

where you continue your careless methods, what sort of a reflection are you casting on your alma mater? Why, men, you are deliberately destroying the future business opportunity of other graduates as well as your own.

Why not start right? You cannot begin too early. From the first day you enter the laboratory let cleanliness and care be your chief ideas. It may take a little longer at first to observe these points but you most surely will save in the end. It is much easier, more rapid and satisfactory to do a piece of work carefully, even though slowly, once, and know your results are right, than to hurry through it, and be obliged to repeat it, not only once, but several times perhaps before you have obtained any clear interpretation of your results. True, this is an age of haste, rapid work, efficiency, and results, but efficiency is the keynote of success. Without efficiency, all your haste and rapid work can never give you results, and results are what count nowadays. And cleanliness in your work means efficiency in that work.

As I have already said, the balance is the most important piece of apparatus in laboratory work. It should be tested at least once a day to be kept true and in perfect balance, and when not in use the pans must be left absolutely clean, weights put away, and the balance case closed.

Perhaps you consider these points a waste of time, too trifling to bother with; but I can tell you that you will waste more time trying to get results from poorly kept balances and weights that have been left lying around anywhere than you would ever use in keeping them in perfect condition and always on hand. Some of you will say that such details are too petty, too trifling, when there is so much to be accomplished, so many greater things to take up a man's whole attention. Yes, I know they may seem small; but habits of care and cleanliness once thoroughly inculcated do not encroach on any of the seemingly bigger

things—they are so much second nature, so automatic and involuntary, that they do not require any of that attention and concentration so essential to the accomplishment of the chief aim, the ultimate result.

I think there should be a system wherever chemistry is taught by which a student is absolutely obliged to make cleanliness the first principle in his work, especially when using the scales in dyeing problems. Of course, when weighing the dyes and the other materials used in the dye bath it is almost impossible to prevent small particles from being scattered about at times; but all traces of foreign matter should be removed and the scales left in proper condition for the next user. I have seen balance pans—and, in fact, the whole inside of a balance case—so smeared, stained and, actually, thick with liberal samples from previous use that there was considerable difficulty in getting the scales to move at all, and yet this apparatus was in constant use. Of course, it may seem a harsh measure, almost like removing old landmarks, to get rid of some of these accumulations of weeks, perhaps months; but when you have your apparatus in working order again—that is, if it is possible to do so after such neglect—see to it that it is kept that way. If a new balance is required, get it; make a fresh start; make it right, and keep up the standard of your work.

Remember that nothing less than the best work is conducive to the best results; the man who pays attention to details is the man who succeeds; care means the greatest attention to details, and cleanliness is one of the greatest evidences of care, both as a cause and as a result. Let us keep a more careful watch in the future in this respect. See that the laboratory desks, shelves, containers, and all apparatus, especially the balance—everything—is kept in the best possible condition, and you will appreciate the greater confidence felt in your results, the more complete reliance placed in your methods.

Faults in Fabrics Due to Chemical Causes

A Paper Recently Read Before the South of Scotland Section of the British Textile Institute

By D. K. COLLEDGE

IN the course of a short paper it is impossible to treat of every individual fault, and I am therefore confining myself to those faults that have a chemical origin.

For the better consideration of the subject I have classified the faults as follows: (1) Due to defective oils; (2) faults in scouring and bleaching; and (3) faults in dyeing and finishing. Dealing with the defects due to oils, we deal with a subject that, considering its importance, has been very little investigated.

In the finished material, oil of any description is a fault. From the dyer's point of view the oiling of wool causes deterioration no matter what oil is used. Allowing that oil is a necessary evil in spinning operations, it cannot be too widely known that certain kinds of oil give rise to a large series of faults, among which we have dull shades, uneven or blotchy dyeings, stains, yellowish whites, rubbing, and inferior fastness of colors. These faults are, of course, due to defective scouring; but then it is impossible by the use

of soap and soda to remove certain oils from the material. Apart from the class of yarn—for example, hard-twined yarns are difficult to clean—we have to remember that the ease with which the material is scoured depends on the class of oil used. The question arises: What is the best oil to use, since the aim of the manufacturer is not to be able to cure faults but to prevent them? The ideal oil is the one that fulfills the spinning function, and that can afterwards be easily removed. We have a large selection of oils which fulfill the first condition, but comparatively few of them can be easily removed by scouring. Many vegetable oils emulsify easily, but mineral oils cannot be emulsified with soap; therefore, we must avoid mineral oils, though these are often cheaper, and therefore used as adulterants. How should we know them? The following rough test is useful:

It is not possible to scour these oils except with the organic solvent process. The point to keep in mind is that mineral oils are harmful in scouring operations. The second point in dealing with oils and scouring apparatus is not sufficiently well known. The use of soda ash alone as a scouring agent is only possible when the oil contains free fatty acid, although oils containing no fatty acid are easily removed by soap. Thus the oil should not only be free from mineral oils but should also contain a fairly large percentage of free fatty acid (40 per cent).

Another difficulty arising directly from oils occurs when the material is steamed in the oil, such as newly spun yarns for winding, etc. It should be kept in mind that when subjected to the action of steam certain oils undergo a change—polymerization—and this change is bad from the scouring point of view, since polymerized oils cannot be removed by soap. Stains occur in the steaming of pieces from the same cause. If these faults do occur, the only way to remedy them is by use of an organic solvent such as benzol, ether, alcohol, etc. Oil stains in general are removed by organic solvents.

The chief features to be kept in mind in scouring are the quality of reagents employed and the temperature of operations. Raising the temperature to increase the speed or to save scouring material is poor economy. Faults that occur and arise from scouring operations are defective dyeings through the inability of the dyestuffs to be taken up by the fiber on the top of the grease, tendering of material, and poor whites. Very little need be said about these points, as they are well known to every dyer, although in many cases they are not sufficiently emphasized. Even in some of our up-to-date works the thermometer is looked upon as a theoretical toy, and the quantity of reagents used usually depends upon some rule-of-thumb idea.

The following result of tendering of yarn was obtained by recent careful trials for the purpose of clearing up a point which arose from a complaint of tendered goods. Many who teach the destruction of material in scouring operations may say that their theo-

ries are confirmed by practice, but I defy any so-called thoroughly experienced practical man to detect by feel or appearance the following results: The yarns were heated for half an hour in 5 per cent soda ash at the following temperatures: One at 100 deg. Fahr., two at 140 deg. Fahr., three at 180 deg. Fahr., and the loss of strength by heat at 180 deg. Fahr. as compared with 140 deg. Fahr. was 4 per cent; and I say that a man may scour many qualities of wool at 160 and 180 deg. without detecting which is which, in feel or handle. This is only one operation, and a loss of 4 per cent in one operation is far too much. Difficulties may also occur in scouring through formation of lime soaps. These latter are formed whenever soap solution is poured into water. To avoid the formation of lime soap stains, a good supply of soft water is necessary, but so far as my experience goes we are fortunate in that respect in this district. When the soap is poured into hard water a scum rises to the surface and a certain amount of sediment is formed, and this is used as an indication of lime soaps. We may also have lime soaps formed by scouring lime wools, and, as every scourer knows, these are a great source of trouble. Lime soaps are troublesome owing to the fact that they are sticky and almost insoluble in water. They settle out on the material and stick there, preventing the uniform absorption of dyes and causing stains in white yarns. The usual practice in this district for the removal of these stains is to run the piece in a weak solution of HCl, but this in itself is insufficient. The action of HCl is to break up the lime soap and dissolve the lime, but this leaves the fatty acid of the soap still on the goods. This can be removed either by soda solution or, perhaps in stains, better by organic solvents. Another fault arises when scoured material, especially piece goods, is not sufficiently rinsed when it has to be afterwards chromed and dyed. Chrome as well as lime soaps can be formed, and this gives rise to cloudy dyeing. These faults are rarely detected until they are dyed, when it is too late to rectify them. I may also point out that in examining these faults it is not always possible to analyze the substance left on the fiber, and only indirect proof can be given. Proof usually depends upon the response given by the stains.

A great deal of attention has been paid in certain districts to the cleansing of wool by organic solvents—dry cleaning. As far as I can judge, no attention has been given to it here, but it is the only rational method of cleansing wool, and is bound to come into force sooner or later, and manufacturers laying down new plants for scouring would be well advised to keep this fact in mind.

Faults due to bleaching are many and varied, but it is only fair to add that the title should be "Faults Due to SO₂ Bleaching." The well-known methods of bleaching are (1) SO₂ and (2) H₂O₂ bleach. Modification of these two methods may be in use, but they are only modifications. I have never yet come across a

fault caused by H_2O_2 bleach, and it is surprising that so few firms working a high class trade use it. It is certainly more expensive, but the results are so much superior that with a high-class trade it is cheaper in the end. The principle upon which the bleach depends does not seem to be understood, since one of the most amazing features that I have come across in bleaching is to find certain firms using both methods on the same material. The sulphur bleach gives rise to fading colors, and colors bleeding in the milling, and these two faults cause sufficient damage. It seems to be a very general fallacy that if the material is passed through a soap solution after bleaching, the cause of the trouble is removed. It may be lessened, but certainly it has not removed the cause, as passing through a soap bath only converts the H_2SO_3 to a sulphite, and later this may cause trouble. Some of the defects that arise have been cured with H_2O_2 , but this is not always possible and the only way to cure some is to prevent them.

I believe that more faults occur in dyeing and finishing than in any other operations, and in many cases it is very difficult to detect the cause of the fault. In many cases faults appear only during these two operations, the cause of which has been on the material all along. Although most faults do occur or come to life in dyeing, the present practice of everyone blaming the dyer and the dyer blaming every other department does not lead to a solution. It is difficult to lay down chief causes of faults, especially in dealing with these two operations. Every fault requires a separate investigation. Faults that occur are uneven dyeing, tendering, bad penetration, loose colors. If uneven dyeing occurs, and is the fault of the dyer, then it is due to carelessness or attempting to rush. Everyone knows that some dyestuffs are difficult to dye with; even yet that is the dyer's affair, and is up to him to take the necessary precautions. Every dyer knows the precaution—slow dyeing; but, on the other hand, uneven dyeing may be impossible with material as it comes to the dyer. Then, in yarn spun from mixed wools, say in an extreme case carbonized and uncarbonized wools, or unevenly spun yarns, and poor oils, are all causes for which the dyer cannot be held responsible. Bad penetration is just another form of uneven dyeing, and has like causes. In these causes, uneven and blotchy dyeing, especially in chrome colors, is often caused by insufficiently rinsing after scouring. When entered in the chrome bath, if any soaps remain, chrome soaps are formed and these are insoluble and sticky to the piece, giving cloudy dyeings. In the finishing operations it is natural that scouring causes most of the faults. This is sometimes the dyer's fault, but more often the fault of the scourer. The tendency to hasten scouring and milling operations by using strong liquors cannot be too severely condemned. The dyer has only limited possibilities in the dyeing of fast shades, and he cannot dye fast

colors if none is available. Sometimes the fastest known colors are not used. This is not always the fault of the dyer. In some cases the dyer has to depend on the color manufacturer, and that is only satisfactory within limits. It seems surprising, considering the trouble caused by loose colors, that with a large college equipped for this class of work it is only in a very few cases that questions have been asked about colors. Questions on this subject would cast no reflection on the dyer. If the latter has no time or apparatus for experiment, how is it possible for him to experiment? The present method of trying new colors on a pattern lot is not satisfactory. Apart from the hot scouring liquors causing faults (it should be remembered that 20 deg. difference in scouring liquor will cause a difference of 2 to 3 per cent breaking strain in the cloth), allowing the goods to lie wet is very bad for colors. Many colors fast enough to scouring bleed when they are allowed to lie wet, even after soap solution is removed.

Greater co-operation between designer and dyer might avoid many losses, since a very small difference in shade will make all the difference between a fast and loose color, and in making up samples the designer might well inquire whether the shades can be dyed fast. When faults do occur in this way, the remedy depends on various factors, such as a color which has bled other colors in the piece, and so on. It is not always possible to sort them, and separate investigation may be necessary. Some are curable with Glauber's salt, others with hydrosulphite, and in one case where hydrosulphite clears the white but strips the other colors in the piece a mixture of hydrosulphite and formaldehyde is successful. In dealing with this class of faults tendering of the piece must be avoided, but as this point is so elementary no one with common sense would forget it.

Steam and pressing operations may also cause defects. Steam has a more destructive effect on certain colors than hot water. If steaming takes place before dyeing, to avoid cockling it should be kept in mind that steam gives wool a greater affinity for dyes, and this may give rise to uneven dyeing. A fault of this description is almost impossible to rectify.

As I have already stated, many of the faults do not come under any special heading but require separate investigation.

Careful and systematic investigation of faults would pay, not only in correcting a faulty piece but in avoiding future trouble. If careful records of faults were kept, this would be a valuable guide to the prevention of other defects, and would be useful in pointing the way to the solution of problems arising from obscure causes. Further, the numberless points brought to light in these investigations, which very often develop into researches, would be of immense help in the improvement of processes.

The Uses of Copper Salts in Textile Treatment

By A. J. HALL, B.Sc.

COPPER is a comparatively common and cheap metal and in many ways has made itself useful to the textile industry. Salts of copper are largely used in dyeing, printing and finishing.

In dyeing copper salts are used in consequence of their power to act as catalysts. Any element which can change its valency is always likely to be a useful catalyst, and copper can be mono-valent and di-valent. Hence, in aniline black dyeing, copper sulphate is largely used to assist the oxidization of aniline hydrochloride by means of sodium chlorate.

AN EARLY DISCOVERY

It is now nearly ninety years ago that Runge noticed that when copper chloride was added to a solution of aniline nitrate and heated to boiling, a dark green coloration resulted, and this quickly turned to black. This observation was not utilized till some thirty years later when Lightfoot made use of copper salts for the printing of aniline black, and since then the copper-aniline black process has been developed, so that to-day it is probably the one most largely used.

In the use of the copper-black process a great deal of care has to be taken so as to avoid any tendering of the fiber. Tendering is certain to take place to some extent because of the acid present in the padding liquor. But some recent research work has shown that tendering is due not to the acid alone, but partly due to a catalytic action produced by the copper. In these circumstances it will be seen that the copper-black process can never be so safe as the prussiate process, where free acid is largely neutralized by the sodium ferrocyanide used.

Often it is necessary to decide whether aniline black dyed fabrics have been treated by the copper or the prussiate processes.

The method for distinguishing this is not difficult and depends on a few properties of copper salts which are highly characteristic.

TESTING COPPER

If sulphureted hydrogen gas (generated by the action of sulphuric acid on iron sulphide or any other convenient sulphide) be bubbled through a solution of a copper salt, an immediate precipitate of black copper sulphide is formed. This precipitate is insoluble in dilute acids, so that it is advisable to add some hydrochloric acid to the solution before testing with the sulphureted hydrogen.

With a solution of potassium ferrocyanide copper salts give a brown precipitate, or a brown coloration, if only traces of copper are present.

Another highly characteristic property of copper, and one which finds a large technical use, is that whereby a solution of a copper salt gives a fine blue color on treatment with excess of ammonium hydroxide.

So that in testing fabric for the presence of copper salts it should be burnt in a silica crucible and then ignited to destroy all organic matter. The residue should be dissolved in boiling hydrochloric acid, and should the solution obtained be blue in color, the presence of copper may be suspected. After the solution has been filtered sulphureted hydrogen should be bubbled through it. If a black precipitate is formed it should be filtered off, washed with hot and slightly acidified water, and finally boiled in yellow ammonium sulphide solution. If the precipitate contains copper (the black precipitate may contain lead, mercury or copper sulphides) it will be insoluble in this reagent, and is again filtered off and washed. The precipitate may then be treated with dilute nitric acid, and after a time it may be filtered from any mercuric sulphide, since this remains insoluble. The solution so obtained may contain lead and copper, and since the former is precipitated by the addition of sulphuric acid, as insoluble lead sulphate, a solution containing copper alone may be obtained. This may then be tested by either of the methods previously described.

If copper cannot be detected in an aniline dyed fabric then it is improbable that dyeing has been carried out by means of the copper black process, since fabric dyed in this manner always contains a certain proportion of copper. The cloth should then be tested for iron, since the presence of this metal would indicate that a prussiate process had been used.

Although copper salts are not largely used as mordants they find an extended use in dyeing. This is because it has been found that various dyestuffs have an increased fastness to light after treatment with copper sulphate. The exact reason for this is not known, but probably some kind of lake is formed between the dyestuff and the copper salt.

Incidentally it may here be remarked that it has recently been discovered that acid wool dyes have their fastness to light improved by an after-treatment with solutions containing phospho-tungstic or silico-tungstic acids, and the reason for this is similar to that applying to the use of copper salts.

AFTER-TREATMENT

After-treatment with copper salts is very largely employed for fabrics dyed with direct cotton dyes or sulphur dyestuffs.

(Continued on page 24.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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REGARDING A TECHNICAL TEXTILE ASSOCIATION

IN the Technical Section of The REPORTER for June we ran an editorial entitled "Wanted: A Technical Association of the American Textile Industry." This editorial seems to have created quite a bit of interest among textile and color chemists. Several letters have been received from chemists prominently identified with the textile industry, indicating that they agree with us in believing that the formation of such an association, if properly organized and conducted, ought to prove of material benefit to all textile manufacturers as well as the concerns which supply them with dyestuffs and chemicals. We understand, in fact, that some of the leading textile chemists of the country have gone so far as to take under advisement the question of calling a meeting in the not distant future of some of those whom they feel might be interested in such an association, for the purpose of discussing the possibility of effecting an early organization, an initial meeting to be held, perhaps, at New York, during the week of September 12, coincident with the Chemical Exposition.

The REPORTER feels that a movement of this sort is entitled to most hearty support by all technical elements of the textile industry. It is obvious, of course, that in order to be successful such an organization would of necessity need the financial co-operation of textile manufacturing firms and of other concerns which supply the textile industry with dyestuffs, chemicals and similar materials. This support would be needed primarily in order to defray the expenses of serious research work, which it would be one of the chief functions of such an organization to undertake.

Elsewhere in this section there is published an announcement to the effect that the Society of Dyers and Colourists, of Great Britain, has established a fund to assist those of its members who are deemed competent

to conduct research on some twenty problems relating to dyeing, bleaching and finishing of textiles, upon which the society feels that further technical information should be secured. This merely serves as an instance of what might be attempted, and undoubtedly accomplished, by a similar organization in this country.

The majority of the textile technicians of America are agreed that legislative protection for the American dyestuff industry is essential. One of the most important reasons for this protection is felt to be the continued development of organic chemical research in America, as it is rightly believed that a native dyestuff manufacturing industry is the only industry of sufficient commercial size to warrant the maintenance of a vast army of research chemists.

Logically, therefore, if we are to continue to train young minds in chemical channels, the assistance and stimulus to real accomplishment which could be given those who identify themselves with the textile industry by an association such as the one under discussion would be very considerable.

The REPORTER earnestly hopes that all of its readers who are technically trained textile men will lend their hearty co-operation to this movement. We should be very glad to hear from any of our friends who feel that they would care to participate in any pre-organization conferences which may be held and shall be glad to advise them as to the proper parties with whom to communicate.

MISREPRESENTATION VS. FACT

ONE of the most consistent and oft-reiterated charges made by opponents of legislative protection for the American dyestuff industry is that the advocates of such protection in their speeches, interviews and editorial remarks exaggerate, misrepresent and falsify without the slightest regard for the facts in the matter. Personally The REPORTER believes that the issues at stake cannot be exaggerated, that there has been very little, if any, wilful misrepresentation, and no deliberate falsification.

In our opinion, however, it has remained for one of the opponents of the license or embargo measure to contribute the most obvious misrepresentation and false logic which has been sponsored by any party to the controversy. In a recent issue of the *American Economist*, which publication, according to its masthead, is "devoted to the protection of American labor and industries," there appears a front page editorial under the caption "A Timely Exposure," which is devoted to comment on the recent attacks made by Louis Scibold, in the *New York World*, upon the Longworth embargo measure.

According to this editorial, "the dye embargo feature is wholly un-Republican and un-American. It is not designed as a measure to afford the greatest good to the greatest number, but to create a monopoly characterized by the most inordinate greed that ever actuated any interest or interests." The editorial further states that "protectionists are not interested in developing the German dye industry—they prefer to develop

the American dye industry but they do not propose to develop a domestic monopoly which will prey upon every American citizen. The American people have no use for monopolies and those who advocate them would do well to be warned in time."

Further on the editorial states that the only justification for an adequate protective tariff is that "... it creates domestic competition to offset foreign monopoly and hence benefits the consumer by lowering prices; it benefits the entire commonwealth. None of these virtues are possessed by an embargo system. Instead of foreign monopoly it provides for domestic monopoly, and domestic monopoly is no more desirable than foreign monopoly."

In other words, according to the *Economist*, the dye embargo measure, if enacted, is certain to create an American monopoly which, it claims, will be disastrous in its effect upon all dyestuff consumers and the public at large, whereas, if a protective tariff alone is adopted, domestic competition of a healthy sort will result and American consumers will *merely* have to contend with a German monopoly. The *Economist* admits that it does not care particularly for a German monopoly but apparently feels that one of foreign domination is to be preferred to one under domestic control.

Will some good student of economics please tell us in words of one syllable why an embargo on certain classes of dyestuffs now being adequately produced in this country would automatically establish a domestic monopoly, whereas a protective tariff would create domestic competition? And will the same student please advise us—admitting, for the sake of argument, that we must have a monopoly of one sort or another—why it is preferable that we be dominated by a German monopoly instead of one under American control, which, as everyone knows, could be easily regulated by the provisions of the Sherman law, while the German cartel would be entirely beyond the jurisdiction of the United States courts?

If tariff alone will create domestic competition of a keener sort than will embargo, is it not reasonable to suppose, in the ordinary working out of the economic law which provides for the survival of the fittest, that only those of our American concerns which are peculiarly well equipped as to financial resources and manufacturing facilities could hope to withstand the competition? Would not the smaller and less well financed manufacturers of dyestuffs and other coal-tar products of necessity be forced out of existence? The very fact of the necessity for keen competition in an effort to meet foreign prices would quickly force the smaller manufacturer out of business, leaving the manufacture of dyestuffs in the hands of, at best, a very few extremely large concerns. If a monopoly and the consequent elimination of the small manufacturer is feared as the result of the passage of an embargo measure, why is it that all of the small manufacturers themselves are a unit in advocating the enactment of

this legislation? The answer is obvious—they realize that they have a fair chance of competing against even the most powerful domestic competition but that their chances against German competition, restrained only by a tariff, no matter how high, are absolutely nil.

In our opinion these bigoted opposers of the protection and firm establishment of this most important key industry, which has come to us as a gift out of the turmoil of the world conflict, will one day reap the just rewards of their lack of patriotism should their efforts to destroy the American dyestuff industry by any chance prove successful. The kindest thing we can wish for them is that they find themselves compelled to pay exorbitant prices for their needed dyestuffs to a foreign monopoly, within the ranks of which there is no pretense at competition; where, in fact, the very Government itself assists in making consumers pay all the traffic will bear wherever it has successfully eliminated competition. How any man who pretends to call himself an American can for a moment hesitate between the retention and development of an industry so vital to our national existence as the dyestuff manufacturing industry and the calm delivery of this industry, and all that goes with it, to our recent enemies, almost, as it were, "on a silver platter," is beyond our comprehension.

BRITISH SOCIETY STIMULATES RESEARCH IN DYEING PROBLEMS

The Society of Dyers and Colourists of Great Britain has established a fund to encourage those of its members who are qualified to undertake research along certain lines which, the society feels, are of especial interest to dyestuff consuming industries.

Among the subjects proposed for research are the following:

1. The dyeing of kemps in woolen yarn and pieces.
2. The dyeing of a black on cotton yarn to stand a coloring bleach and to be fast to rubbing at a cost not exceeding that of ordinary aniline black.
3. The dyeing of dead cotton present in ordinary cotton yarn or piece goods.
4. An exhaustive study of the Foulard dyed style (tannin caustic discharge, fix in tartar emetic and dye in basics) with a clear indication as to how the various difficulties can be overcome to ensure regularity on commercial scale.
5. A complete investigation of the process of mordanting cloth with soda aluminate for full Alizarine Red.
6. A cheap and efficient means of fixing pigment colors in printing so that they shall stand boiling soap solution.
7. A practical method for the production of fast multicolor prints in combination with print-on-indigo (glucose method).
8. A method of producing a yellow discharge on dyed indigo similar to that obtained with Leucotrop O but fast to washing and light.
9. White and colored discharges on sulphide colors.

10. Colored resists including red under aniline black fast to strong soaping.

11. An investigation into the influence of the various finishing agents upon the resulting fastness to light of dyed feathers.

12. A method of application of sulphide dyestuffs in the dyeing of vegetable, chrome and oil-dressed feathers.

13. A satisfactory method of fixation of acid colors on cotton.

14. The production of a green coupling with Betanaphthol, which can be worked to and in conjunction with para red.

15. A method of obtaining complete penetration of dye through thick leather, preferably employing acid dyestuffs, the leather to be dyed same shade throughout.

16. Possibility of the production of a combination of synthetic tan and dyestuffs to be used in one operation.

17. A thorough study of the aging of iron mordants for production of dark shades in dyeing

It is possible that some of our readers may have done work along some of these lines. If so, The REPORTER would welcome the opportunity to assist in giving consumers generally the benefit of your efforts.

THE USES OF COPPER SALTS

(Continued from page 21.)

In the case of a fabric dyed with direct cotton dyes it is usually worked two or three ends in a dye liquor containing 1 per cent of copper sulphate. The temperature should be moderate (50 to 60 deg. Cent.). Sometimes a change of shade is produced so that it is always wise to try a sample piece before after-treating a whole batch.

If about 1 per cent of sodium bichromate and 1 per

cent of acetic acid be added to the solution of copper sulphate, the fastness of the dyed fabric to washing is also increased.

When fabrics dyed with sulphur colors are treated with a solution of a copper salt the shades are usually brightened and made fast to light. This action may be considered as due to the catalytic effect of the copper in promoting the oxidation of the sulphur dyestuff, but some recent work shows that lake formation also takes place. It has been found that when sulphur-dyed fabrics are treated with a solution containing copper sulphate and acetic acid, they fix a certain amount of copper, and this amount varies with the dyestuff used. Thus fabric dyed with 5 per cent of Thiogene Orange R fixed 0.04 per cent of copper was retained. It seems obvious that the fixed copper will play a large part in the fastness and shade of the dyed fabric.

Incidentally it would appear that sulphur-dyed fabrics which have been after-treated with copper salts should not develop mildew at a later period. Copper salts function as powerful antiseptics.

The results of investigations also show why fabrics dyed with sulphur black should not be after-treated with copper salts. It has been found that sulphur black dyes only oxidize slowly to sulphuric acid if they are free from metallic impurities. But should a metal such as iron or copper be present then the rate of oxidation is greatly accelerated. Hence any copper which may be fixed in a sulphur black dyed fabric will easily lead to tendering.

As is well known cellulose may be dissolved in an ammoniacal solution of copper oxide, and from this solution the cellulose may be easily regenerated. This reaction has been utilized practically for the production of artificial silk and waterproofed fabrics.

(To be concluded.)

Bleaching, Dyeing, Printing, and Finishing

By BENJAMIN LEECH

Consulting Chemist, Macclesfield

Editor's Note.—The following resume of recent scientific articles and developments pertaining to the subjects covered by the above title comprises the latter half of a chapter in the Annual Report for 1920 of the Society of Chemical Industry on Applied Chemistry—the first half of which was reprinted last month. Inasmuch as this volume does not enjoy wide circulation in America, we felt that our readers might be interested in this record which the Society has caused to be prepared. If complete copies of any of the articles mentioned are desired, we shall be glad to refer inquirers to the original sources.

A prize of 20,000 marks is offered by the Verband Deutscher Leinen-Industrieller e. V., Berlin-Bielfeld, for a method of ascertaining the end-point in the retting of bast fibers, and further prizes for a method of avoiding the objectionable odor and injurious nature

of the effluent from the retting process and for a practicable method of drying retted flax and hemp artificially.

An improved method for weighting silk with tin is described in a patent by the Deutsche Gasglühlicht

A.-G.; the fiber is saturated with tin chloride, centrifuged, dried at a low temperature, and treated with an alkaline gas—e. g., ammonia. It is claimed that the whole of the tin is fixed as hydroxide, the weighting obtained two and one-half times that usually obtained, and the rinsing baths are clear and without precipitate. This appears to be a very valuable process, since it saves the loss of tin in the first wash water, the whole of the tin being fixed by the gas before washing. The conditions of "drying at low temperature," it is surmised, must be very carefully controlled to avoid tendering.

The use of a number of products for increasing the strength and elasticity of silk or preventing the tendering of weighted silk is claimed by J. Korselt. The intention appears to be to saturate the silk with materials that are more readily oxidized than the silk fibroin. Suitable substances mentioned are tropine, methylphenmorpholine, pimelic acid, polypeptides, peptones, tryptophane, quinine, etc. It is also claimed that these compounds make the handle of the silk more supple.

In the mercerization of cotton fabrics containing viscose silk, injury to the latter is said to be prevented by the addition of formaldehyde, phenol, glycerin or monoacetin to the caustic soda.

SCOURING PROCESSES, ETC.

Considerable progress has been made in the degreasing of wool with volatile solvents. An excellent paper on the subject is published by H. Hey. Among the solvents which have been proposed, petrol has been found to have the most advantages. It has been found necessary to arrange that the whole of the grease is not removed, but a regulated amount is left in the material. The solvents, unlike aqueous solutions, do not penetrate the cells of the fibers but remove the grease from the surface in a state of pure solution. Other insoluble substances are then more easily removed by mechanical treatment. The disadvantages attached to the use of soap and alkalis are avoided. By this process wool is left in a better condition for carbonizing and there is less risk of damage to the fiber. To economize the solvent successive treatments by small volumes are preferred to treatment by a larger volume in one operation; this affords a means of determining the amount of soluble matter which shall be left on the material. The portions of solvents which contain smaller amounts of soluble matter are used for the first treatment of the next lot of wool material. The author points out that by degreasing wool instead of fleece washing and scouring, the weight of the raw wool would be reduced to 30 to 40 per cent or more, with a corresponding reduction in the cost of carriage and with greater certainty that the wool would arrive in an undamaged condition for manufacture.

A method for cleansing wool by means of oils, such

as kerosene, olive oil, anthracene oil, fatty acids, etc., is described by T. Hollis and A. Woodmansey. The oil is circulated at a low temperature through the material until impurities are extracted and only the clean extraction medium is left on the wool. This oil is then removed by means of soluble oil and treatment in water.

A. Pinagel and Aachener Chem. Werke have patented the use of alkaline saponin and an alcoholic fulling oil for treatment of woolen material containing mineral oil.

L. Rinoldi, after drawing attention to the fact that better results are obtained when wool is washed in a bath which has been used for previous lots, makes the suggestion that this improvement in the used bath is attributable to the presence of albuminoid substance in the bath removed from the first batch of wool. The author describes experiments dealing with the cleansing of raw wool with baths containing glue. It is found that there is 4 to 5 per cent less loss of weight and that the wool is softer and better. The use of baths containing two to three parts of glue for one to two parts of soap is recommended. In preparing garments for redyeing the garment is steeped in a warm 4 to 5 per cent solution of glue without other addition, after which the garments are cleansed by working in water only. The addition of glue to the dye bath is found to assist the penetration and leveling qualities of acid and mordant colors.

S. Begg describes in a very practical way the scouring and milling of fancy woolen piece goods; the paper contains statistical details comparing soap milling with acid milling and the output of different types of machines. The practical details of the operations are very effectively described in considerable detail.

F. Bayer u. Co. patented a method for degumming silk by means of water under pressure. The silk is treated for half an hour with distilled water containing 0.25 per cent of caustic soda under pressure of $\frac{1}{2}$ atm. The novelty in this patent appears to be not the use of pressure but the absence of soap.

BLEACHING

No new bleaching agent has come into general use, nor has there been any striking modification of existing processes.

The bleeding of indigo-dyed threads during bleaching is the subject of a note by R. Aue. The author attributes the bleeding to the reducing action of the dressings in the material in conjunction with the alkali during the scouring. Satisfactory results are obtained by the addition of sodium peroxide ($1\frac{1}{4}$ kg. in 1,000 liters) and boiling at a pressure of 0.3 atm.

For the bleaching of paper yarns and fabrics F. E. Jagenberg suggests a preliminary treatment in a solution of hydrosulphite, rinsing, chlorination for six hours, and souring with a solution of sulphuric and hydrochloric acids, followed by thorough rinsing with sodium carbo-

nate and finally with water. The treatment is repeated and is said to yield a pure white without affecting the strength.

THEORY OF DYEING

In connection with the general theory of dyeing there is little to report. An investigation of the action of salts on the dyeing of cellulose with benzopurpurin by J. Boeseken and others shows that the action is similar to the salting out of soaps. The necessary quantity of electrolyte is considerably greater than equimolecular. In the case of sulphates and chlorides the strongest electropositive metals exert the most powerful action. Except at high concentration, the quantity of dye fixed on the fiber is, within certain limits, proportional to the concentration of the dye.

DYEING PROCESSES

The year is characterized by the absence of new coloring matters, but considerable attention has been paid to refining the methods of application of existing materials.

A new way of dry-dyeing in a bath of carbon tetrachloride is patented by V. Plante. The apparatus used consists of an iron vat containing an iron wire basket in which the material to be dyed is placed, and fitted with connections for an electric current. The solvent used is a mixture of carbon tetrachloride and alcohol to which is added a mordant of ammonium gallotrioleate in addition to the dye. The color is fixed on the fiber by means of the electric current.

The use of the coloring matter in plants for dyeing purposes has been investigated by A. E. Everest. The anthocyan pigments give rich shades which are fast to light but not fast to washing. These glucosides yield anthocyanidins on hydrolysis and both these classes of compound dye full shades on tannin-mordanted cotton. The glucosides have scarcely any dyeing affinity for mordanted wool, but the corresponding anthocyanidins dye readily. The affinity for tannin-mordanted cotton is shown by the author to be due to the presence of the pyrylium ring. The chief drawback to the technical use of these coloring matters is their lack of fastness to washing, even to hot water, and their extreme sensitiveness to acids and alkalis. The author describes researches which have been made into the group of related synthetic compounds, which have not, however, at present yielded dyes of technical importance.

In connection with the production of inorganic colors on the fiber, J. Barnes and others describe the control of the shades produced by mixtures of titanium and iron salts by adjustment of the degree of acidity or basicity of the solution. The effect of the iron is reduced by increased acidity. V. H. Gatty describes the use of a mixture of copper and manganese; the fabrics are padded with a mixed solution of salts of these metals and then passed through a hot alkaline bath.

The dyeing of Aniline Black is the subject of several sealed notes of the Societe Industrielle de Mulhouse.

M. Prud'homme describes a process for wool in which the material is mordanted for five to ten minutes in a bath of 10 to 20 grams per liter of chromic acid, squeezed lightly, washed and dried. It is then impregnated in a cold bath containing aniline and an acid, preferably formic acid, squeezed, and aged. The oxidation is complete in about one to one and one-half hours. The material is then well washed and dried without further treatment. The use of organic acids prevents too rapid oxidation of the aniline in the bath. The use of a concentrated bath is advantageous. In a second note Prud'homme recommends addition of a ferric salt to the above mordanting bath.

Other references to Aniline Black will be found under the section on "Printing."

The dyeing of paper yarns is a problem which has received some attention. The addition of oxidizing agents such as sodium perborate and percarbonate to the dye bath is recommended by Chem. Fabr. Coswig-Anhalt. The substance is in this way rendered more easily impregnated, becomes softer to the touch, and brighter colors are obtained. Additional assistants to the dye bath with substantive colors are boric acid, acetic acid, ammonium chloride, ammonium phosphate.

E. Puschel describes the dyeing of pulp destined to be used for preparing textile yarns. The resin size is added first, then the dyestuff, and finally the aluminum sulphate after half an hour's mixing. No mordant is needed with mineral, basic or acid colors. With acid colors 5 per cent of size gives the best result. If substantive colors are used the pulp should be made neutral or faintly alkaline with soda ash.

In connection with foam dyeing the use of sulphonic acids of xylene and solvent naphtha to promote the production of a foam has been patented by Meister, Lucius, u. Bruning.

Under the research scheme of the Society of Dyers and Colorists a note on black dyeing on tussore silk is published by J. P. Srivastava. The author was at some pains to obtain samples of genuine reeled tussore unmixed with other varieties of wild silks. He has made a large number of experiments in the use of different dyestuffs and finds that the best results are obtained on silk which has been boiled with water only for one hour preparatory to dyeing. The absorption of dyestuffs was in many cases slightly greater by silk treated in this way than by silk degummed completely with soap or alkalis. This result is interesting but of no immediate technical utility, because, as the silk generally comes into the hands of the dyer after manufacture, the treatment with boiling water only would be insufficient to remove the additions made during the process of manufacture. The generally accepted explanation of the difficulty of producing a good black on tussore is that the furrowed nature of its surface causes a scattering of white light in manner quite different from that occurring at the surface of a true silk. It seems possible that the incomplete removal of the gum in the above experiments has led to this surface-effect being less prominent. As regards the

point of absorption, it is known that the absorption of dyestuffs by a silk incompletely degummed is greater than by one from which all the gum has been removed.

In connection with grege silk, E. L. Maupai has patented a method of hardening the gum by preliminary immersion in a solution of a metallic salt.

PRINTING

A novel style is described in a patent granted to the Calico Printers' Association, E. Schofield and F. Farnworth, according to which color effects of a variegated nature are produced by applying one color to the under-surface of the cloth, by means of brushes, in such a way as to secure complete penetration, and immediately afterwards allowing a second color to fall on to the upper surface of the cloth in the form of drops. Mechanical arrangements provide for the regulation of the means of brushing and on the number and size of the drops.

Several papers have been published dealing with Aniline Black in printing. E. Jentsch recommends a method of preparing a padding liquor for "discharge" printing which does not differ markedly from general practice.

A. Scheurer gives the following preparation: Potassium ferricyanide 35 parts, potassium chlorate 35 parts, aniline 65 parts, hydrofluosilicic acid (sp. gr. 1.16) 105 parts, and starch water containing 125 grams per liter 760 parts. No copper, vanadium or hydrochloric acid is used. The color is developed into an ungreenable black by suspension in an ager at 45 deg. Cent. For colored resists under Aniline Black P. W. Pluzanski recommends a printing paste containing caustic soda and stannous chloride. For blue or yellow, Indanthrene Blue or Flavanthrene is used, or the cloth may be first prepared with beta-naphthol and the resists developed with diazo compounds.

For printing with basic dyes, A. Stiegler recommends the use of lead acetate instead of antimony salts. Lactic acid is added to prevent formation of the lead color lake in the printing paste.

In connection with indigo, A. Scheunert and N. Wosnessensky recommend a discharge paste containing zinc oxide and Leucotrope W in addition to the usual caustic soda and glucose. M. Battegay reports very favorably on this process.

For direct printing of indigo blue, L. Caberti, C. Barzaghi and P. Roggieri recommend a paste containing anhydrous sodium sulphite, ammonium oxalate, and zinc powder. Baumann reports that good results are obtained. Ammonium hydrosulphite is formed by the above compounds in the paste.

The gray produced by indigo by printing with starch and olive oil followed by steaming has been shown by R. Haller to be an optical effect due to the reflection of light by the particles of pigment adhering to the fiber. Graphite adhering in particles to the fiber produces a similar effect.

The discharge of alumina, chrome and iron mordants which are fixed on the cloth as tannates may be successfully performed with alkaline pastes. A patent has been

granted to the Calico Printers' Association for such a process.

FINISHING

As softening agents in finishing, glycol is suggested by T. Goldschmidt A.-G., and the use of the amyl ether of beta-naphthol for increasing the softness and flexibility of artificial silks has been patented by Bayer u. Co.

In the beetling process the use of a continuous rubber sheet wound on between successive layers of cloth is suggested by J. H. Wrigley and A. B. Henshilwood to avoid the production of water-mark effects and to equalize the effect of beetling on different parts of the cloth. Attention has been drawn to the detrimental effect of the presence of small amounts of oil or grease on beetling, and a patent has been taken out by J. D. Lumsden, W. R. MacKenzie, E. H. Robinson and M. Fort for a process for removing the grease with dry solvents before beetling.

A special finish by means of the Schreiner calender is described by J. B. Lomax. The fabrics are passed through a calender under very heavy pressure and at as high a temperature as they will withstand without injury. Immediately on leaving the calender the cloth receives a finishing liquor consisting of a boiling solution of alizarine oil. The cloth is then wound on rollers and allowed to stand for ten to twelve hours, and is finally stretched and stentered.

As a textile dressing and especially for fixing powders or pigments on textile materials, water-soluble phenol-formaldehyde condensation products are suggested by F. Gunther. The addition of a cellulose ester increases the elasticity of the product.

PROOFING

Fabrics may be proofed against soiling or staining by applying a solution of cellulose nitrate or acetate superficially. The cellulose solution is prevented from soaking into the fabric by first impregnating the latter with a volatile liquid such as benzene.

A fabric made of wool mixed with the silk obtained from the innermost layer of the cocoons was one of the products of the war. It is found to be much more permeable to water than a woollen fabric, and ordinary water-proofing methods do not give satisfactory results. G. Colombo describes a process resembling decatizing which considerably decreases the permeability to water of such fabrics.

Insoluble alginates, formed on fabrics by padding with a soluble alginate and then passing through a bath of zinc sulphate or similar heavy metal salt, separate in colloidal form and give a waterproof finish which resists a boiling neutral dye bath, according to a patent by E. Naefe.

For rendering balloon fabric impermeable to gases the use of a mixture of rubber and cellulose acetate has been patented by Soc. Anon. Etabl. Hutchinson. This mixture can be applied in the form of a colloidal mixture in such solvents as tetrachloroethane.



MEN OF MARK in the DYESTUFF FIELD

WILLIAM A. KINGMAN
Chemist
Dennison Manufacturing Co.
Framingham, Mass.

WILLIAM A. KINGMAN was born in Marshfield, Mass., in 1876, and received his preliminary education in the lower grade schools of Holliston, that State. Moving to Framingham in 1890, he graduated from the Framingham High School and entered the Massachusetts Institute of Technology, receiving the degree of Bachelor of Science in 1900. He immediately began working on the production and application of viscose in the research laboratory of the Cellulose Products Company, Boston, and in March of the following year took charge of the company's factory. A few months later saw him with the Viscoloid Company, Leominster, supervising the preparation, nitration and washing of cotton, working on the production of new colors and carrying on analytical work incidental to the manufacture of nitrocellulose. In May, 1905, he undertook research work on the yield of nitroglycerine by small-scale nitrations for the Eastern Laboratory, Gibbstown, N. J., a control unit for the production of the nitroglycerine and dynamite products of E. I. du Pont de Nemours & Co.

His connection with the Dennison Manufacturing Company dates from May, 1906, and began with experimental work on colors, adhesives and resins in connection with the manufacture of crêpe and gummed paper, paste and sealing wax. On subsequently taking charge of the laboratory he developed and systematized the special methods of physical and chemical testing of raw materials necessitated by the unique uses to which these materials were put by the Dennison Manufacturing Company. Original procedures for testing the water content of fish glue, the presence of injurious sulphur compounds in jeweler's tissues, the value of paper for tags, for bill straps and for jewelry cards; the adhesiveness of glue for labels, the suitability of dyes for crêpe paper, of lakes for coated paper and for paper napkins, were among the problems worked out.

At the outbreak of the war he took over the purchasing of dyes, lakes, dry colors and printing inks, and also the supervision of all color mixing and matching for crêpe paper, napkins, coated paper and sealing wax, overcoming the difficulties attendant upon maintaining strictly pre-war standards of shades of color. At the close of the war he began research work on improving and standardizing methods of manufacture, with special reference to crêpe-paper products, while retaining supervision over the purchase and application of dyes.

Mr. Kingman firmly believes that every American chemist should feel a personal responsibility in educating the layman to the fact of the equality, if not the superiority, of American chemistry to that of Germany or any other nation; that he should spread the gospel of the quality of American dyestuffs in no uncertain manner, and that he should lose no opportunity to overthrow pro-German propaganda relating to dyestuffs or to chemicals in general.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the **AMERICAN DYESTUFF REPORTER** by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

A. S. P.—Question: Please give me an explanation of the differences in chrome mordants and their effects on colors.

Answer: A true chrome mordant is a very basic, insoluble chromium salt in chemical union with the wool fiber. Its color is bluish green and it is not capable of being extracted by boiling water. Such a mordant is the result of complete reduction of the bichromate by a sufficiency of tartar, lactic, oxalic, tartaric, formic acids or bisulphites. It serves to fix the true mordant dyes by forming with them insoluble chromium lakes. With hematine it gives a navy blue and with alizarine a claret red. The average chrome mordant as noticed in wool dyehouses is seldom thoroughly reduced and consists mostly of chromium chromate, a combination of chromium hydroxide with chromic acid. This mordant is of a yellow or buff color and has still some oxidizing power and may be partly removed by boiling water. With such a mordant dyers may use logwood extracts and what are called hematines, because both contain some unoxidized hematoxylon, which the mordant develops and fixes. Many mordant dyes are unaffected by oxidation (e. g., Alizarine Yellow) and dye very well on such a mordant, but, in the case of easily oxidized dyes and those made soluble by the use of bisulphites, such as Alizarine Blue S, Galloxyaniline, Alizarine Red WSB, etc., there is sure to be a bleeding of the free chromic acid into the dye bath and a precipitation of the dye as a lake. Such lakes may affix themselves to the wool loosely and appear to make a full shade but they will not be fast to washing and rubbing.

Then we must consider the class of dyes developed and fixed by after-chroming. Some reduce the chromic acid and become fixed without much change of shade while others, especially the chromotrope series, require to be thoroughly oxidized, when a new color develops and increased fastness results. One-bath methods are simply processes in which the mordant goes on the wool first and then fixes the dye but which do not precipitate the color in the bath.

These facts show that the nature of the dye must be known and the process selected accordingly, paying particular attention to the fact of whether the dye requires oxidation or not.

S. E. B.—Question—I am interested in dyeing of furs and will greatly appreciate any information you can give me as to the following:

1. What are the chemical names of the dyes known on the market as "Fur Black" and "Fur Brown," and where can the same be obtained? Also, how are they to be used to obtain best results—i. e., what bath, mordant, etc., is to be used?

2. Are there any other dyes made for the dyeing of furs besides those mentioned, and where can same be obtained?

Answer—The chemical name of the dye known as "Fur Black" is Paraphenylenediamine, and the "Fur Brown" is Paramidophenol. Both of these dyes are used in conjunction with peroxide of hydrogen, which oxidizes them on the fur. In order to obtain the best results a mordant must be used.

A number of different mordants may be used which will in different cases produce different shades on the skins. Chrome, copper, iron and combination mordants are used in different cases with success. The formula for an ordinary chrome mordant is as follows: Two grams bichromate of potash, $\frac{1}{4}$ gram copper sulphate, 2 c.c. acetic acid 50 per cent, and 1 liter water.

There are other colors which produce yellowish and bluish-gray shades, and which may be obtained in the market.

One concern which specializes in fur dyes is the Seydel Manufacturing Company, of Jersey City. Among leading manufacturers of paraphenylenediamine is the Sherwin-Williams Company, and of paramidophenol is E. I. du Pont de Nemours & Co.

Review of Recent Literature

Woolen and Worsted. Roberts Beaumont, M.Sc., M.I.M.E. 716 pages, 6 $\frac{1}{2}$ ×10; cloth; \$10. New York, D. Van Nostrand Company.

This is the fourth edition, revised and enlarged, of the author's already world-known treatise on the subjects indicated. The theory and technology of the manufacture of woolen, worsted, and union yarns and fabrics is covered with a thoroughness which omits no slightest detail. The author has demonstrated in actual practice, to his own satisfaction, the workableness of the theories advanced as governing each operation. In method of construction, plan and scope this volume sets forth the whole scheme of woolen and worsted manufacture and examines and describes the types of mechanism employed in yarn and fabric production.

In order to accomplish so comprehensive an object, unity of design and minuteness of analysis are essential—the whole subject must be presented and studied with due consideration of its distinctive units. The author

holds that woolen and worsted manufacture can only be effectively interpreted when analyzed and explained from this standpoint; that is to say, an exposition of, first, the processes as separate units of work; second, of their influence in connection with each other; and, third, of the effects of each on the accuracy and completeness of manufacturing routine. The present book is built on experimental study and research. It comprises schemes of thought and of observation which have been formulated and perfected in close relation with actual factory operations and commercial conditions, and yet carried out in harmony with educational ideas.

Under the general headings of Raw Materials, Yarn Construction and Fabric Structure, the spinning qualities of the staples of different materials are dealt with, and also the styles of fabrics to which they are, for trade purposes, applied; the qualities of the yarns resultant from the chief varieties of wool are analyzed and the effect of the system of yarn formation practice is explained.

The processes of manufacture are treated of as they are performed on standard types of machinery. The various systems of carding and condensing cheviot and Saxony yarns are explained and compared. Worsted yarn preparation on both the English and French principles is fully considered. The principles of design, drafting and the elements of textile coloring are extensively illustrated and dissected. Various weaves and types, design bases and compound plans are discussed in relation to the theories of weave structure and origination. Many examples in textile mathematics are given, with extremely lucid explanations of the rules and principles involved. Extensive tables are given on systems of counting yarns, methods of changing yarn counts and methods of counting reeds. Fabric analysis for weave and cloth structure, yarn counts, quality and fibrous composition is completely discussed.

In short, the volume comprises a complete textbook on the manufacture of woolen and worsted fabrics, written by an authority who has added to a thorough comprehension of the theories involved the practical experience necessary to prove these theories in practice. The subject matter is grouped under the following general headings: Materials; Woolen Yarn Manufacture—Wool Sorting, Scouring and Blending; Woolen Yarn Construction—Carding, Condensing, Spinning and Twisting; Worsted Yarn Construction; Yarn Structure—Folded and Fancy Twist Threads; The Principles of Fabric Structure; Fundamental Weaves; Loom Mounting; Hand-Looms; Power-Looms; Weave Combinations; Drafting; Pattern Design; Color Applied to Plain, Twilled and Fancy Weaves; Compound Fabrics; Fabric Analysis and Calculations; Finishing of Fabrics; Investigation of Problems in Manufacture.

A Dictionary of Chemical Solubilities (Inorganic). A. M. Comey, Ph.D.; Director Eastern Laboratory, E. I. du Pont de Nemours & Co., and Dorothy A. Hahn, Ph.D., Professor of Chemistry, Mount Holyoke College. Sec-

ond edition, enlarged and completely rewritten. Cloth, 8 vo, 1,141 pages; \$14. New York, The Macmillan Company.

The new edition of this work is in every way the most complete dictionary of inorganic chemical solubilities. The solubility of each substance in water is given first; then follow the specific gravities of the aqueous solutions, the data regarding their boiling points; then the solubility in the inorganic acids, in alkali and salt solutions, and, finally, in organic substances. Where more than one result has been obtained by research workers, data from all original authorities are cited. To the material retained from the earlier edition the authors have added an equal amount of new data drawn from chemical periodicals of the last twenty years, covering the entire field of inorganic substances. The arrangement in dictionary form follows the plan of the first edition, the single alphabetical order adapting the work to ready reference.

The work has the following outstanding features: (1) The solubilities of all analyzed inorganic substances are included; (2) in addition to the inorganic substances, the solubilities of the simpler carbon compounds such as the carbonates, cyanides and ferrocyanides are given; (3) a single alphabetical order has been preserved throughout, applying equally to important and to rarer substances; (4) the compounds of metals with one of the non-metallic elements have been classified under the metals; (5) the salts of the oxygen acids have been arranged alphabetically under the acids; (6) the authors have made a thorough study of all European and American periodicals dealing with chemical research and have cited the exact source of each report; (7) a synchronistic table of the more common periodicals is given in the appendix, thus providing a simple means for determining the date of the publication of the report.

The Manufacture of Earth Colors. Dr. Joseph Bersch; translated from the third German edition by Charles Salter. 216 pages, 5x7½; 31 illustrations; cloth, \$3.00. New York, D. Van Nostrand Company.

This present volume is a revision (by Prof. Dr. Wilhelm Bersch) of a hitherto standard work now brought up to date by the addition of much material in connection with the mechanical appliances for treating color earths and manufacturing them into pigments. Following an introductory chapter, the list of contents includes: The Raw Materials for Earth Colors; The Preparation of the Color Earths; White Earth Colors; Yellow Earth Colors; Red Earth Colors; Brown Earth Colors; Green Earth Colors; Blue Earth Colors; Black Earth Colors; The Commercial Nomenclature of the Earth Colors.

AMERICAN DYE STUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

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IN 2 SECTIONS
SECTION 2

IN THIS SECTION

"More Science in Wool Scouring," by a well-known chemist in this field, deals with economies resulting from the introduction of chemical control, and the chemist's place in the wool-scouring establishment.

In an article entitled "Testing the Fastness of Dyed Colors to Light," H. B. Gordon discusses the relation between the strength at which colors are dyed on the fabric and their subsequent fastness to light, and shows how this relation may be used to shorten the time of testing.

Sentiment crystallizing in favor of a Technical Association of the Textile Industry—See editorial page.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 9, No. 5

NEW YORK, AUGUST 1, 1921

Section 2

More Science in Wool Scouring

A Scientific and Economic Discussion of Certain Phases of the Wool-Scouring Process

[Written for the AMERICAN DYESTUFF REPORTER by the chemist of a large wool-scouring establishment, who has requested that the article be published anonymously. All rights reserved by the author.]

SCOURING wool is one of the oldest of textile processes, and yet it is not carried on to-day upon nearly as scientific a basis as many of the newer processes; as is, for instance, dyeing. Almost all scouring is done by "rule of thumb."

DIFFICULTIES OF STRICT CHEMICAL CONTROL

To place a wool-scouring plant under strict chemical control is rather a hard matter for many reasons, the chief of which is that the management very often does not care to change what it considers a successful operation. Then, too, generally the character of the different lots of wool will vary a great deal, and the results desired will vary just as widely. These two latter reasons, especially, apply to work in a plant doing custom scouring for the trade.

Plants doing custom work, of course, have to handle all kinds and varieties of stock. The bulk of their work is generally done for wool dealers, and as the dealer never knows just what use may be made of his wool he usually insists upon a harder scour than an owner, who may be going to rescour the yarn. Very often the dealer wants his lot scoured to match a previously scoured sample, having in mind the idea of selling the new lot to the same customer who took the former. Of course, the custom scouring plant does a lot of work for mills directly, in which case it must scour strictly in accordance with instructions, which vary a great deal among the different mills.

While it is impossible to apply a set rule for scouring all varieties and grades of grease stock, there are a number of general rules, or instructions, which may be applied with great benefit even in a plant handling all kinds and varieties of stock. In plants scouring their own stock, where the grease stock and the result

desired are more or less uniform, a closer set rule may be applied.

THE FOREMAN AND HIS TRAINING

In most of the plants which it has been my pleasure to visit I have found that the men in charge of the scouring have not received any training in the theoretical principles of scouring. Generally, even the foreman has entered the plant as a laborer, and has worked up through the positions of feeder, washerman, foreman and, sometimes, superintendent. While in most cases this is an excellent plan if the man is earnest and willing to learn, it often, nevertheless, places men in supervisory positions who have absolutely no knowledge of the theoretical side of their work and very little judgment. Yet these foremen are often very capable in handling the men and in getting the work out in quantity. They have had years of practical wool experience, and with proper instruction and assistance, by means of chemical control, they are by far the best men available for the work.

Then, too, these foremen may have numerous and widely located operations under their supervision, so that it is a physical impossibility for them to keep a close check upon all operations. This places the responsibility even more upon the washerman, who is sometimes an illiterate foreigner with absolutely no judgment. He merely does what he has seen someone else do, and hopes for the best—if he cares that much.

VARIATION IN SCOURING COSTS AND SOME OF THE CAUSES

Considering these conditions, which I do not think exaggerated, it is not strange that you find monthly scouring costs for chemicals (soap and soda com-

pounds), in what is considered a well-managed scouring plant, varying between 18 and 45 cents per 100 pounds of stock scoured.

It is not unusual to find a washerman dumping bucket after bucket of soda ash or other scouring compound into the last or latter bowls of the washer, where it cannot be washed out of the stock before it goes to the dryer. The chances are that he has never been told, in so many words, not to run up the soda content of the last bowls. He has generally been told to get a certain result and, for some reason which he does not understand, he is not getting it. He knows that there is plenty of "kick" in the soda compound used, and that the latter bowls are not so heavily charged; hence he places it as he thinks best. In many cases he is not much to be blamed, because he uses his best judgment, which in such instances does not amount to much. Neither is the foreman to blame. He cannot be everywhere at once, and very often the washerman makes sure that the foreman is out of sight before he starts experimenting. It is only natural for the washerman to have confidence in his own ability to overcome his troubles, and very often it happens that the more ignorant he is the more confidence he has in himself. The only way for the foreman to keep a close check of what is going on, and what is in the bowls, is by chemical control. And the man to blame for the above conditions is the manager who places **any** man in charge of **any** operation, no matter how simple, who has not received at least some elementary theoretical instruction in regard to the operation.

VARIATION IN SODA CONCENTRATION

In order to give some little idea as to the extent of the variation in the soda concentration of the various bowls of a five-bowl washer, supposedly under close observation but not under chemical control, I have attached Table I. These washermen were old experienced men, but had never been given any particular instruction. The figures given are per cent of soda in the liquor, calculated as sodium carbonate (Na_2CO_3) or anhydrous soda ash.

The first four lines give the soda ash per cent in the bowl liquors as found in machines scouring fine Australian wool. The same chemicals, soap and soda ash, were used in charging all the fourteen washers, the difference being only in quantity used.

The fifth to eighth lines, inclusive, give some idea as to what the washermen were using to scour a half-blood wool, and the last six lines indicate what they were using on some stock supposed to receive a "light scour."

It is not hard to find variations of over 1,000 per cent in judgment—if in some cases it can be called judgment. Yet these figures are from a supposedly well-supervised mill.

Table I tells only a small part of the story. It does not show such variations as: How long the various

TABLE I
*Alkalinity of Scouring Liquors, Calculated as
Per Cent of Anhydrous Sodium
Carbonate, Na_2CO_3*

Fine Australian Wool				
Bowl No. 1	Bowl No. 2	Bowl No. 3	Bowl No. 4	Bowl No. 5
1.85	0.73	0.60	0.54	0.12
0.63	0.99	0.37	0.63	0.08
0.44	0.25	0.23	0.20	0.10
0.38	0.31	0.32	0.18	0.44

Half-Blood Wool				
Bowl No. 1	Bowl No. 2	Bowl No. 3	Bowl No. 4	Bowl No. 5
0.85	1.00	0.57	0.20	0.16
1.40	0.92	0.38	0.40	0.02
0.75	0.80	0.72	0.63	0.18
0.60	1.12	0.80	0.47	0.30

Light Scour				
Bowl No. 1	Bowl No. 2	Bowl No. 3	Bowl No. 4	Bowl No. 5
0.26	0.26	0.42	0.31	0.24
0.38	0.31	0.31	0.31	0.14
0.26	0.29	0.23	0.20	0.02
0.74	0.94	0.60	0.57	0.51
0.26	0.38	0.36	0.18	0.40
0.90	0.63	0.50	0.32	0.03

bowls were run before the liquor was changed, when the liquor was "freshened up," the temperatures maintained, speed of the feed, etc. However, you may be sure that these showed as wide a variation as the soda content of the bowls.

ADVISABILITY OF CHEMICAL CONTROL, IN ADDITION TO GENERAL RULES AND INSTRUCTION FOR WASHERMEN

Soon after these figures were obtained a few general rules were made governing the bowl charging, so that the men had some general idea from which to work. At the same time the washermen, and particularly the foremen, were given several talks upon the general theory of scouring, the action of soap and soda compounds upon the wool, etc.

Chemical control was then installed to the extent of determining the soda concentration in the bowl liquors every hour.

In this way everybody, from the washerman to the mill management, is kept posted on just what is going on in the bowls so far as soda is concerned. As soon as the soda concentration becomes too high in any bowl or machine, or when the soda increases unduly in the last bowls, it is immediately called to the atten-

tion of the foreman, who investigates the cause and reports it to the chemist.

With even this comparatively crude method the results are surprisingly satisfactory as compared with the former manner of operation. In a very short time the washerman gained an excellent idea of just what was wanted, and also of the fact that he had no chance to experiment without being discovered at once. The result is a much lower and more uniform cost of chemicals, practically no stock to be rescoured, and therefore an increased production, a lower and more uniform shrinkage, more uniform scour, and better results and satisfaction in every way. The men are more than satisfied, as they are able to obtain better results without so much guesswork.

While this method places some check upon the men, it leaves plenty of room for them to use all their judgment and years of experience. If they are scouring to match a sample, the washerman is free to use his own judgment, combined with that of the foreman, as to how to obtain the desired result, but as soon as anything unusual occurs, as shown by the analyses, the foreman's attention is drawn to it by the chemist, and he (the foreman) is required to report the cause to the chemist.

Whether this method of control and the instructions given really improved the men's judgment, or whether it merely made them more careful, I do not know; but I do know that the results were distinctly worth while.

All the soda determinations are made in the laboratory by a boy, volumetrically, under the supervision of the chemist, and a permanent record kept of all titrations, together with the lot number, washer, etc. A copy of this record goes to the mill superintendent and the plant manager daily. The titrations are not calculated to per cent of sodium carbonate, but are reported as cubic centimeters of half-normal acid required by 100 cubic centimeters of scouring liquor sample. This saves considerable time and avoids error in calculations or conversions by the boy.

GENERAL RULE FOR CHARGING BOWLS

The general rule for charging, referred to above, for the standard-size five-bowl washer is as follows:

TABLE II	
Dry Soda Ash (pounds)	1% Soap Solution (pounds)
First bowl 25	None to 20
Second bowl 12	40
Third bowl 12	40
Fourth bowl 6	40
Fifth bowl 0	None to 20

Of course, this is a very general rule and is varied for each lot of wool, but it gives the washerman a

definite idea of about the general order of charging each bowl. The general rule is to use all five bowls on even a light scour; but to charge them light, according to what is wanted.

In case only a four-bowl scour is ordered, the third bowl is charged as for the fourth, and the fourth bowl charged the same as the fifth, in which case the fifth may be only warm water. If a three-bowl scour is ordered, the first bowl is charged with warm water only, and the rest of the bowls charged as for the four-bowl scour.

In case the washer, as charged, does not give the desired result, the washerman or foreman is at liberty to make whatever changes he thinks necessary; but the idea is to keep as near to the rule as possible, and in any case to charge in about that order.

Enough soap is always kept in the bowl to make a lather, the amount of which varies with the location of the bowl. Soda is added to the bowls as required to "freshen up," but the liquor is not allowed to become very dirty. When the first bowl or bowls become dirty, they are dropped and the latter bowls are pumped forward.

In charging the bowls at starting, the dry ash is placed directly in the bowls, but in freshening up the ash is placed in wire boxes set in the rake frame, similar to ducker boxes, so as to be dissolved gradually.

When limy pulled wools are scoured, the soap is omitted from the second bowl charge as well as the first bowl. Both first and second bowls are changed frequently so as to remove as much lime as possible before the stock enters the soapy liquor.

Good squeeze rolls are, of course, necessary for good work. In any case, more or less alkali, soap and dirt are gradually carried along into the latter bowls. With good rolls this is reduced to a minimum.

In order to keep up the rate of feed the men were placed upon a bonus system; and while this is in some cases a little hard to handle, it has been entirely satisfactory so far.

IMPORTANCE OF TEMPERATURE CONTROL

In regard to temperature: I think that very few mill managers, and practically no mill operatives, realize just how very important this matter is in regard to strength. The effect of this variable was plainly shown in Prof. Louis A. Olney's article on wool scouring in *The AMERICAN DYESTUFF REPORTER* for April 4, 1921. It is hard to make the men realize that a difference of only 10 or 20 degrees Fahrenheit in scouring temperatures will make a very decided difference in the amount of noil combed out of the wool, and hence in the value of the lot.

I have seen a great deal of carelessness shown, not only by the washermen but by the foremen, in the matter of temperatures. In many mills it is left almost entirely up to the washerman to decide at what temperature he will run the lot. Often he is not even provided with a thermometer. However, this is not

so serious in some cases, as I have seen some of the more experienced men estimate the temperature very closely by hand. But even these better men, when using the old valve method of steam regulation, very, very often get their temperatures away up. The washerman finds the temperature down on one or two bowls and "cracks" the steam valve. He then sits down or goes up to the dryer to see a sample, and the result is that when he again thinks of the temperature it is up to about 150 or 160 degrees Fahrenheit. He then turns off the valve and the temperature drops until it is too low again. Is it any wonder that the lot is often unevenly scoured?

AUTOMATIC TEMPERATURE CONTROL

The new automatic temperature controllers have been very successful, in my experience, except for one fault: they are a little hard to regulate to just the desired temperature *quickly*. About the only time the washerman wants to change his bowl temperature is when he is changing lots. The result is that the regulation of the temperature controller must be done just when he is changing lots, which generally means changing water also, recharging, pumping forward, etc. Another serious objection in many mills is the high cost of these controllers.

I once saw several bowls equipped with electric thermostats. These were arranged so as to ring a bell whenever the temperature varied over 5 degrees Fahrenheit either way from the set point. These were cheap to install, but shared the fault of the automatic temperature controllers in the respect that when the time came for a change in lot and temperature they had to be regulated at the time of change. Also, they had to be switched off when changing water in order to keep all the bells from ringing at once. The thermostats were roughly calibrated, so that it was not very hard to change after the operator became familiar with them.

I have also seen recording thermometers used on the bowls and dryers. These have the advantage of giving a permanent record of the temperatures, so that the

washerman knows that if he becomes careless the management is sure to know of it.

The old-style, large-size red alcohol thermometers, suitably protected, can be arranged, one in each bowl, so that "he who runs may read." In this way everyone passing the machine can readily see the bowl temperatures. Any of these arrangements make the washerman far more careful on this important point. The automatic controllers are, I believe, the most satisfactory in the end.

THE CHEMIST'S PLACE IN THE WOOL-SCOURING ESTABLISHMENT

In concluding my remarks I might add that I believe almost any mill of any size will find it a good investment to let a competent and tactful chemist study its scouring problems. The chemist should give a series of instructive talks to the men as a class, and individual talks to the men while they are working in the mill. The men should have an opportunity to become well acquainted with the chemist and to ask all the questions they desire. The chemist must be exceedingly tactful in order that the men may not feel that he is a "know-it-all" trying to trip them up on something, but rather that he is trying to help them with any problems they may have, and likewise that he, also, is willing to learn all that he can about scouring.

This is the age of education and specialization. It pays in the long run to employ the more intelligent class of labor, for the employer reaps the benefit of the employee's training whether the employee gets it of his own volition or through the employer. Even the progressive department stores are to-day holding instruction classes for their employees.

Chemical control will more than pay for its cost in chemicals saved, and he who installs it will profit from the advent of far more uniform work, lower shrinkages, more even dyeings, larger production due to less rescouring, satisfaction, and a feeling of assurance that is always lacking in a hit-or-miss process.

Testing the Fastness of Dyed Colors to Light

Qualifications for Ideal Light—Efforts at Standardization—Rates of Action and Current Required—Relation Between Dye Strength and Fastness to Light—Shortening the Testing Time Through the Employment of Weak Shades

By H. B. GORDON

(U. S. Testing Co., Inc.)

THE inadequacy of the methods in common use for testing the fastness of colors to light is generally admitted, and has been discussed so frequently that it need receive no extended consideration here. The

chief difficulty involved in this test is to secure a satisfactory light. A light for this purpose should be reproducible and constant, both as to quantity and quality of light, and should produce the same changes in the dyed

material that sunlight, to which the material will be exposed in actual use, will produce. The objections to sunlight are that it is too variable, both as to quantity and quality, and that it is too slow. Artificial lights have usually proven either too slow in action or different from sunlight in effects.

VARIETIES OF LIGHT EMPLOYED FOR TESTS

With a view to obtaining data that may assist in the standardiation of this test the writer has compared the actions of the light from two well-known types of quartz mercury arc lamps, a violet carbon arc lamp, winter sunlight in Arizona, and summer sunlight in New Jersey. Over sixty dyed samples were exposed to these lights. Several dyes of each class were used in the study. It was intended to study dyes of very great and very slight fastness in each class, but this was not always practicable.

After the completion of the tests the samples were examined and were divided into seven classes according to the degree of fastness. For practical purposes one may say that the samples exposed to the two mercury arc lights were affected in the same manner, and that the degree of fastness to the two lights was in each case essentially the same. The rate of action produced by the two lamps differed, which may have been due to a difference in the ages of the lamps, as the efficiency of this type of lamp varies greatly with the time it has been in use. The samples exposed to the violet carbon arc light and to sunlight in Arizona and New Jersey showed very similar effects in nearly all cases. It appeared that the effects of the arc light were more nearly like those produced by either sunlight than were those of the other sunlight. The classification with respect to fastness was also essentially the same whether the effects of the carbon arc light or either type of sunlight were considered.

RATES OF ACTION

The effects of mercury arc lights and sunlight (or violet carbon arc light) were often very different in character. Thus many colors which faded in the sun became gray or brown under the mercury arc. A considerable number of dyes which were classed as moderately or extremely fast to mercury arc light were given much lower classification to sunlight. In a few cases colors were given slightly higher classification with respect to sunlight than to mercury arc light. The mercury arc light is much more rapid in its effects than sunlight, but owing to the different effects of the two lights it is sometimes hard to make a fair comparison of their rates of action by ordinary means. In some cases it appeared that an hour's exposure to the mercury arc was equivalent to ten days' exposure to Arizona winter sunlight, while in other cases it seemed hardly equivalent to one hour. In most cases the effect of the mercury arc seemed to be from fifteen to thirty-five times as rapid as that of the Arizona winter sun, but it must be borne in mind that the rate of action of the mercury arc light may be five

times as rapid when the lamp is new as when it is old. The action of the New Jersey summer sun was, on the average, four or five times as rapid, and that of the violet carbon arc was three or four times as rapid as that of the Arizona winter sun. The rapidity of action of New Jersey summer sunlight as compared to that of Arizona winter sunlight is probably due in part to the high humidity accompanying the former.

In order to make a more accurate comparison of the relative speeds of action of the different lights used, a few samples which had been exposed to Arizona sunlight and the corresponding samples which had been exposed to the three arc lights were studied with the aid of the Hess-Ives Tint Photometer. Each sample examined had one unexposed portion and portions which had been exposed to light for three periods of different lengths. The carbon arc apparently acted about twice as rapidly as the Arizona winter sun. In one case the effect of the mercury arc was about forty times as rapid as that of the sun, while in another case it was too slow to measure.

CURRENT REQUIRED FOR TESTS

During this study the mercury arc lights required about 750 to 800 watts and the violet carbon arc about 1,800 watts. Since the action of the former was very much more rapid than that of the latter, it is evident that the cost of testing a sample by means of the mercury arc is much less than that of making the test with the carbon arc. However, arrangements can easily be made for testing a large number of samples at one time, thus making the cost per sample very moderate. When the effects of the mercury arc are regarded as satisfactory this lamp may well be used, especially when there is need for the quick completion of the test, but as its effects are so often different from those of the sun it is obviously unsatisfactory as a source of light for a standard test.

SHORTENING THE TESTING TIME

By giving an exposure to the carbon arc of, say, seventy-five hours, under the conditions of this study, a very fair test can be made, as a change would be produced in all except the extremely fast dyes. The light may be permitted to act day and night, so such a test would not necessarily take much over three days. If it is desired to shorten the time of the test it can be done in several ways. For most purposes a sample need be exposed only until a change is produced, which, for fugitive dyes, is not very long. The rate of action of the light varies, of course, inversely as the square of the distance of the sample from the arc. This distance, during the present study, was twenty inches. If this distance were shortened to ten inches the time required should be only one-fourth as long as with the arrangement used, but owing to the heat of the arc, unless special arrangements are made for cooling the samples, there is danger that part of the change of color will be due to heat when the sample is so near to the arc. An attempt was therefore

made to find another means for shortening the duration of the test.

It has long been recognized that any dye is more quickly affected by light to a noticeable degree if in a weak shade than if in a stronger one, but so far as the writer has been able to learn, no effort has been made to express this relation in anything approaching a quantitative manner or to make use of it in testing the fastness of dyes. It has only been looked upon as an inconvenience in making such tests. If dyes are not of the same hue it is impossible to judge the relative intensity of their color with any accuracy by the usual means, and changes in color, due to light or other causes, are correspondingly hard to judge.

RELATION BETWEEN STRENGTH OF DYE AND FASTNESS TO LIGHT

A number of series of samples dyed with varying per cents of different dyestuffs were secured. Portions of each sample were exposed for different lengths of time to the action of the mercury arc light, the duration of the exposure varying according to the fastness of the dye studied. An appreciable change was secured in the weakest shade of a series by the shortest period of its exposure. One color component of each exposure on each sample was measured by means of the Hess-Ives Tint Photometer. For some samples of each series all the primary colors were measured. From the changes in color values resulting from the action of light on the different samples of a series it is easy to obtain a relation which may be considered as showing the relative fast-

ness of the different samples and thus the relation of fastness to the per cent of dyestuff used. From the data obtained it appeared that, for the dyes studied, increasing the per cent of dyestuff fourfold increases the fastness by about 60 per cent, and increasing the dyestuff used eightfold about doubles the fastness. This is on the assumption that the fastness of color varies inversely as the change in its color value, measured with the Hess-Ives instrument. By using this conclusion one may shorten the time of fastness tests by dyeing the samples to be tested with smaller per cents of dyestuff than are to be used in practice and shortening the exposure accordingly. Thus if the per cent dyestuff used in dyeing the sample is only one-eighth as great as that which would be used in practice, the time may be divided by two, or if it is one-fourth instead of one-eighth of that per cent, the divisor should be 1.6. The appropriate time of exposure to the violet carbon arc would then be, say, thirty-five or forty-five hours, which is not excessive.

From the data obtained in connection with this and similar studies, the writer has drawn conclusions regarding the probable relation of intensity of color of a dyed sample to per cent of dyestuff used in its preparation, and also the relation between the time of exposure to light and the amount of dye destroyed by it, but the discussion of these subjects lies beyond the scope of the present paper. For these discussions and the data obtained in the studies the reader is referred to the writer's more extended papers in the *Color Trade Journal*, December, 1920, and the *Textile Colorist*, January and March, 1921.

Dyes in Camouflage

The Following Article by E. Duhem in the Revue Generale des Matieres Colorantes, Translated in the Dyer and Calico Printer, Is of Considerable General Interest to Dyers and Those Interested in Dyestuffs.

The Extent to Which the Textile Industry and Allied Lines Contributed to the War Is

Just Beginning to Be Understood, a Fact Which Is Well Illustrated by

This Description of the Way in Which Dyes Were Used in Camouflage

CAMOUFLAGE was used very intensively towards the end of the war, and brought chemistry and the art of dyeing largely under contribution. I assisted in the first attempts at camouflage, which were made on August 5, 1914, in the Chateau de Rambouillet district. These experiments proved at once that it was possible to render infantry much less visible in the open.

The simple application of picric acid in solution on the hooded cloak of the soldier lent invisibility at 600 meters in the green fields, and especially with a woody background. Practical experiments were made on different parts of the uniform. The alizarine red of the soldiers' trousers was blotched with blue and yellow, according to the methods of the impressionist artists. The guards at

the Chateau camouflaged in this manner were no longer moving targets.

At 1,200 to 1,500 meters the blue of the old military clothing was easily recognized as blue by means of a field glass, no matter on what background. At the same distance black uniforms might be confounded with a ruined building or a cart. The old dark blue was much more visible.

Ordinary khaki was invisible among the ripe barley and oats, and fairly so on the sandy road, but, on the other hand, was very visible with a green background.

Indigo was not manufactured in France at this time, and methods of producing a horizon blue were suggested

and discussed. No immediate result followed, but gradually a modification of the military uniform by camouflage became necessary, especially after September, 1914, when the front line was stabilized. The troops instinctively masked their dress with branches or foliage when the trench was in the woodland. The red of the kepi and of the trousers became unrecognizable in the sandy mud of Artois and Flanders and in the clayey mud of Champagne. Artists and decorators were employed right at the beginning to camouflage gun carriages, cannons, locomotives, wagons, and all the military impedimenta. These were rainbowed, or rather zigzagged, in diverse colors, and, seen from a certain height, they assumed an indefinable neutral tone, approximating nearly to the soil, and being capable of confusion with it.

In course of time it became necessary to fit the color to the season, and the natural tints of the various districts at different times of the year, greener in the Vosges, more nearly approximating gray in the chalky terrain of Champagne, and browner in the sandy districts.

I remember perfectly that the suggestion was made on August 5, 1914, to have a tent cloth green on one side, cutch brown on the other, with white cloth in between. Why were these three colors suggested? In order that the patrol men and sentinels could drape themselves in the green cloth if the background was verdant, or in the brown material if the background was light or dark brown. The white cloth was to serve them in a snowy season, as every color stands out clearly on a snowy background. A 5 to 6 per cent dyeing of Cachet de Laval, an ordinary bath with the dyers, gave immediate satisfaction in all terrains except the fields and woods. These tent cloths were fixed to the kepi, sleeves, and trousers by means of five safety pins, and rendered the soldier nearly invisible.

This idea was a seed which germinated and flourished eventually, but there were so many urgent things to be done at the beginning of the war and so many things to think about that it is understandable that it was slow in development.

Commencing with 1916, the shelters were masked by colored raffia, dyed bright green, medium green, a full solid shade of green, dark green, the green of the dead leaf, bronze, and in fact all the shades of green in nature. Nitroso-naphthol gave all these various tints.

Raffia, dyed and dried, packed on the shelters easily took fire under bombardment, and rotted in contact with wet earth. It was necessary, therefore, to make the dyeings impermeable and incombustible. We shall astonish dyers in general by asserting that the first dyeings were rejected as too regular and too uniform. Absolutely even dyeings did not seem natural. It was necessary to deceive the eye, not only of the terrestrial observer, but also that of the man in the aeroplane, who was much better able to pick out poor camouflage. About one million square meters of raffia was used on a front of a hundred kilometers. We give some of the recipes used for dyeing.

The vat of lined cement could deal with 33 kilos of raffia at a time, and the bath was made up for this quantity. The bath was made with 33 kilos sulphate of ammonia, 66 grams of sulphate of iron, or 66 of boric acid. Then 1 kilo 320 grams of nitroso-naphthol in paste was dissolved in 10 to 15 liters of cold water, and added. The bath was heated to 80 deg. Cent., and the raffia entered, dry and well opened, as it is not easily saturated. It was worked with a stick, at the opposite end of the bath to that where the heat was applied. The green develops well.

To make raffia impermeable and waterproof the following bath was used:

1,000 parts water
40 parts gelatine
30 parts formaldehyde
10 parts castor oil
120 parts sulphate of ammonia

For the 33 kilos of raffia the first bath was made with 13.2 liters of pyrolignite of iron at 10 deg. B., that is to say 40 per cent, and 500 grams of nitroso-naphthol—i. e., 1½ per cent. It was brought gradually to the boil, and 66 kilos of sulphate of ammonia were added. The raffia was then worked for twenty minutes without reheating the bath. The goods were not rinsed after dyeing. In the second bath the same quantity of pyrolignite of iron and the same percentage of nitrosonaphthol were used, diminishing the amount of sulphate of ammonia by one-third, and in the following bath the sulphate was reduced to half.

In the first bath for the 33 kilos of raffia, 2 kilos 300 grams of sulphate of zinc and 1 kilo 650 grams of nitroso-naphthol were used. After boiling for thirty minutes the goods took a beautiful greenish yellow, and 66 kilos of sulphate of ammonia were added. After ten minutes boiling the raffia took a green tint. If this was judged not to be sufficiently green, 15 grams of sulphate of iron dissolved in 15 liters of boiling water, were added gradually at the two ends and in the middle of the bath and well stirred in. In the second bath and the following one the amount of sulphate of ammonia was diminished.

The nitroso-naphthol, sulphate of ammonia, and other dyewares were furnished by the Service du Camouflage, and the dyers used this ammonia salt and other materials without reflecting about the incompatibility of these products. There were inevitable decompositions, the most marked being that of sulphate of ammonia under the action of heat. This decomposition is used in wool dyeing and in certain cases for union goods, but it is harmful for the raffia. The ammonia is evolved and the sulphuric acid remains free in the bath. Consequently, as the raffia is not washed after dyeing there is a considerable tendering of the fiber. Raffia, before dyeing, is very tough and not easily torn asunder, but dyed in this manner and dried it is snapped as easily as cotton.

The sulphate of ammonia furnished, the ordinary

chemical used as a fertilizer, contains a good deal of iron and for yellowish shades, produced with nitroso-naphthol and acetate or sulphate of zinc, the dyer was much astonished to see a green produced as soon as he added sulphate of ammonia to the bath. The processes given out to the trade, therefore, had to be modified. When the dyeing was too green some dyers added 1 to 1½ per cent of Solvay soda, and the iron was transformed into the oxide, which turned the shade yellow.

Chrysamine and Chrysophenine, and other yellows fast to sunlight, were often added to the nitroso-naphthol. Sulphur colors were rarely employed.

Each shade had to be studied not only from the point of view of dyeing, but also from the photographic point of view. There are a good number of colors that do not show on the photographic film, and the snapshot of the aeroplane observers when these colors were used pointed out exactly the camouflaged places. It was necessary, therefore, that the colors should agree well with the background, both from the point of view of the observer with the field glass and that of the camera. Nitroso-naphthol gave every satisfaction in carrying out these conditions. The padding machine was much used in the art of camouflage.

Steam Consumption Tests

Made on Rodney Hunt Piece Dye Kettles at One of the Largest Dye Houses in the United States

THE high price of fuel has made the question of steam conservation one of the most important considerations in the reduction of operating costs.

In co-operation with one of the largest textile manufacturers in this country, the C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y., scientifically analyzed this problem in connection with the dyeing operation as typical of the finishing processes. The result of this investigation is submitted to the textile industry.

The tests were performed to determine the steam saving effected by automatically controlling the time and temperature in the dyeing operations instead of by depending upon the attendant's memory and judgment; and to show further that more uniform dyeing would result by these exact automatic methods.

SOURCE OF STEAM SUPPLY

This mill operates four turbines, two of which may be bled for steam requirements in the dye house. The bleed from one is sufficient under average conditions. It supplies exhaust steam at 8 pounds pressure through a 24-inch header to the dye house.

When only the dye house is in operation, and other departments of the mill are shut down, there is no load for a turbine. At such times, high pressure steam is required direct from the boilers and reduced at the dye house.

INSTRUMENTS USED IN TESTS

The instruments used in the performance of the tests were a Bailey fluid meter, integrating type C-2, No. 424, chart No. 20150; designed for steam at 8 pounds pressure, 5 per cent moisture. Chart reading X-100 = pounds per hour. Orifice was located in a four-inch vertical steam line and just before the point where the steam entered the diaphragm motor valve. The meter was located above the orifice. A recording pressure gauge. This

gauge recorded the pressure of the steam entering the dye house through a twenty-four-inch line. An indicating steam pressure gauge was connected to the four-inch line supplying steam to the kettle, at a point where it would indicate the steam pressure available at the kettle. A recording thermometer. The bulb stem of this recording thermometer was suspended in the kettle and fastened to the side about two feet from the false front and two feet from the bottom. A Tag Roesch automatic time-temperature controller. This instrument is so designed and arranged that it can be set to obtain a boil in a definite period of time and to maintain the boil for another period of time. This was accomplished by placing the thermostatic bulb stem in the dye kettle in the same location as the bulb stem of the recording thermometer. The controller-mechanism automatically opened, closed or throttled a diaphragm motor valve on the four-inch steam supply line to the kettle.

The kettle used was a standard Rodney Hunt piece dye machine, reel designed for eight-piece set, exposed surface of liquid 80½ inches by 69 inches. Weight of dye liquor 4,500 pounds.

A usual charge of dyestuff was used as follows: Naphthol Blue Black, enough to dye black on chrome bottom; 1 to 1½ per cent chrome and equivalent of tartaric acid.

The specifications of the cloth were: Average length of each piece 68½ yards. Average weight per yard 10.8 ounces. Shrinkage in scouring and dyeing 4 per cent in length and 8 per cent in width. The average piece ran through in 54 seconds or 1.28 yards per second or 76.80 yards per minute.

CONCLUSIONS

Of the twenty-seven tests that were run, each covering a complete dyeing operation, fourteen were under the complete control and supervision of the dye kettle attendant, while thirteen depended upon the functioning of the Tag Roesch time-temperature controller.

Average steam consumption per hour operating hand valve, 1,982 pounds

Average steam consumption per hour with automatic control, 1,286 pounds.

Steam saving effected with automatic control, 28 per cent.

Burning one pound of coal generates nine pounds of steam.

With coal costing \$10 per ton, it would seem as though the cost of steam for each kettle per hour would be over \$1. The automatic controller will effect a saving of 28½ cents per kettle per hour.

As most of the sixty-six kettles are twice the size of the No. 7 kettle under consideration, it is safe to assume that the saving is effected on the equivalent of 100 kettles, the size of No. 7. Therefore, multiplying 28½ cents by six, the number of hours each kettle is using steam each day, by 100, the number of kettles, equals \$171 saving in steam per day in the dye house. The saving in a year based on a 278-day year would be \$47,538.

In commenting on these tests the report of the C. J. Tagliabue Manufacturing Company says: "We have repeatedly been told that a man operating one or more dye kettles, has complete control over the dyeing process with respect to time and temperature. True enough, he does know that opening the hand valve on the steam line one and a half turns should obtain a boil in one hour. This naturally would follow if all of the conditions for every boil remained uniform. But because of varying steam pressure, different initial temperature of dye liquor, changing weights of cloth and fluctuating dye liquor levels, it is impossible to even approximate the correct time and temperature factors by hand regulation.

"In the tests under discussion, the steam pressure varied between three and eight pounds. For the purpose of the test, an indicating steam gauge was installed on the kettle, and the attendant thus was able to roughly correct these fluctuations after they occurred. When the gauge indicated a drop in pressure, the attendant increased the valve opening and when the gauge indicated an increase in pressure, he decreased the valve-opening.

POINT OF CORRECT BOIL

"As every kettle is not provided with an indicating steam gauge, the attendant has no guide to indicate the pressure fluctuations and consequently no assurance that the boil will be reached in a definite period of time. Likewise, when the boil is reached, the attendant knows that a given pressure passing through the valve opened to the extent of one and a quarter turns, will maintain a gentle boil. However, when the pressure falls, the temperature falls also, and as a result the maintenance of a gentle boil does not materialize. On

the other hand, when the pressure increases, the boil is maintained but at the expense of steam passing through the liquor greatly in excess of the amount required for a boil. This is another operation wherein the attendant cannot be expected to give his entire attention. Even if gauges were installed, the attendant still would be unable to manipulate the hand valve at the precise moment that the fluctuation occurred. Furthermore, he is not expected to devote all of his attention to the time and temperature factors.

"Even with an indicating pressure gauge on each kettle, hand regulation of the temperature of the dye liquor is out of the question with the following mentioned variables to contend with:

"A uniform pressure delivered to each kettle would not assure us that a one and a half turn of the hand valve would bring the liquor to a boil in an hour, or, that one turn would maintain a gentle boil, unless the initial temperature of the dye liquor, the height of the liquor in the kettle and the weight of the set were always the same.

"Perhaps the attendant gradually becomes quite accustomed to filling the kettle with water to the same height before adding the dyestuff, but a difference in level only to the extent of three or four inches means the heating of approximately fifty gallons more or less.

"The initial temperature of the dye liquor varies appreciably. The attendant neglects this factor entirely. One set weighs more than another. The writer recalls seeing eight-piece sets that weighed as little as 300 pounds, and others that weighed 450 pounds. The heavier set carries more liquor with it over the reel and hence dissipates more heat units in the form of radiation and convection.

FLUCTUATION IN PRESSURE DELIVERY

"While there is no appreciable pressure variation of steam as it is delivered to the dye house in the twenty-four-inch line, there is a wide fluctuation of the pressure delivered to the individual kettles, as noted by the writer in observing an indicating pressure gauge. A reading was taken about every fifteen minutes from this gauge.

"The pressure variation at the kettle is, no doubt, due to the fact that the header supplying steam to a row of kettles, is not of sufficient capacity when all of the kettles on the row demand a maximum amount of steam at one and the same time. The header may have been of sufficient capacity originally, but from time to time more kettles have been installed.

"It should be pointed out at this time that it is easy to regulate the temperature of the dye bath with high pressure steam than when using exhaust steam, principally because the rate of flow through a fixed opening of a hand valve varies only slightly with the usual fluctuations in high-pressure steam, while it varies

greatly with the pressure irregularity or an exhaust line.

"Guesswork should not be tolerated. It is not conducive to efficiency or maximum production in the dye house. A drop in temperature might not influence the dyeing operation of woolen and worsted sets, but it might be found disadvantageous in union sets. It would require a longer time for the process and more labor. A sudden rise in temperature accelerates the chemical action of the dye on the fiber and results in shady pieces.

DYEING PIECE GOODS

"In the dyeing of piece goods, varying temperatures of the dye liquor are responsible for many irregulari-

ties in the finished shade, because successful application of the dyestuff depends upon dyeing at the temperature prescribed by the dyestuff manufacturer at which his particular color can be best distributed and absorbed by the fiber, not overlooking the time period and temperature factor which might be responsible for the exhaustion of the dye or the change of shade.

"Close attention, therefore, to the time-temperature factors as prescribed by the dyestuff manufacturer, and the boss-dyer, should tend to eliminate the following irregularities: Loss of fiber strength; hard and brittle fibers; bust-ups; matted goods; excessive dyestuff; strippings; felted goods; shaded goods; streaky goods; run-overs; waste of steam; loss of time; increased labor cost, and loss of production."

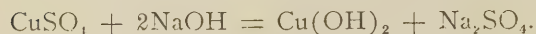
The Uses of Copper Salts in Textile Treatment

By A. J. HALL, B.Sc.

(Concluded from last month.)

WATERPROOFING

For waterproofing purposes a solution containing about 2 per cent of copper is suitable. Copper sulphate is dissolved in water and caustic soda is added to precipitate blue copper hydroxide according to the equation:



It is better to use a slight deficiency of caustic soda. The copper hydroxide is filtered off and washed free from the sodium sulphate which has been formed, and is then dissolved in the least possible amount of an ammonia solution 0.920, specific gravity. It is then possible to dilute the blue solution to the desired strength.

When fabrics, such as those to be used for tent materials and wagon covers, are drawn through this solution, the exposed fibers are partially parchmented. Hence on passing through a calender, the air spaces in the fabric are largely filled up by means of a film of cellulose. The ammonia is dried out of the fabric during the calendaring process, leaving the copper as a deposit within the fibers.

Fabrics waterproofed by means of cuprammonium hydroxide are proof also against mildew on account of their copper content. On the other hand, they are less permeable to air than those fabrics which have been proofed with alumina-acetate soaps, and this is an undesirable feature.

ARTIFICIAL SILK

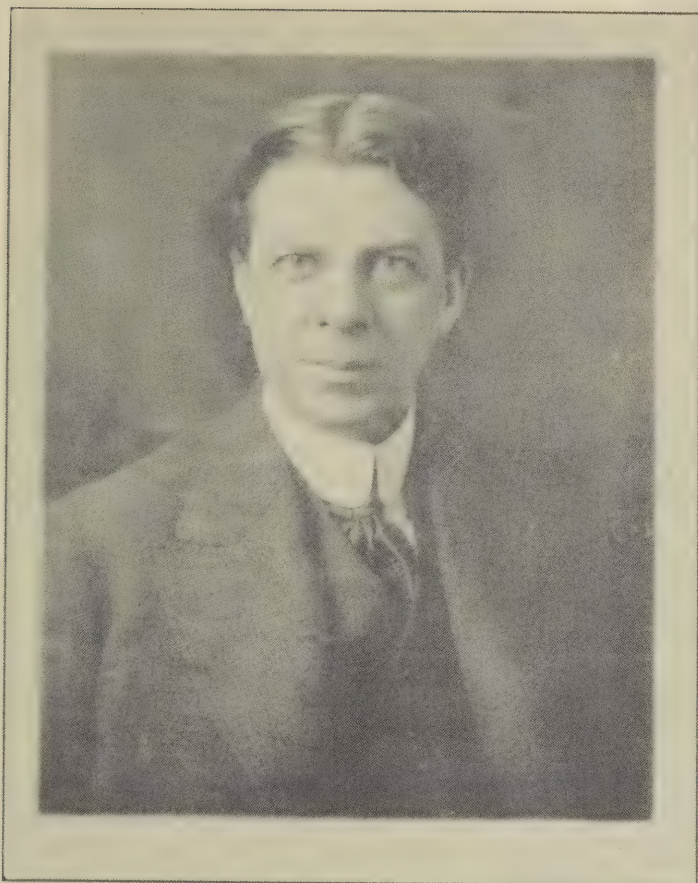
In the manufacture of artificial silk, and the viscose and cellulose-acetate processes have not entirely replaced the cuprammonium process, mercerized or hydrated cotton is employed. This is more easily soluble than pure cellulose. The cuprammonium solution is prepared as described or is made by exposing copper turnings to the action of ammonia and air for several days until the copper goes into solution. Sometimes lactic acid is added in order to help the copper to dissolve.

The cellulose is kneaded with the cuprammonium solution and is then filtered. Since cellulose solutions are very viscous only a 5 to 10 per cent solution is used. Finally, the filtered solution is squirted through fine jets into a solution of sulphuric acid, the resulting thread is thoroughly washed and then dried. Cellulose threads prepared in this way are **fairly uniform** and may be used for textiles with advantage since they are strongly lustrous.

LOGWOOD DYEING

At one time copper salts were largely used in connection with the dyeing of logwood on cotton and wool. Copper sulphate was the salt most frequently employed. Nowadays, logwood has decreased in importance as a cotton dye, but copper sulphate is still largely used for wool dyeing with logwood. Hence it is desirable that some rapid means for the estimation of copper be available. The following method gives good results and is easily carried out.

(Continued on page 25.)



MEN OF MARK in the DYESTUFF FIELD

E. S. GRAVES

General Manager

Franklin Process Company

Providence, R. I.

E. S. GRAVES was born in Chicago, Ill., in 1876, and received his preliminary education in the public schools of Cleveland, Ohio. Entering the Case School of Applied Science, that city, he obtained his degree as chemist upon graduation and undertook his first work on the application and manufacture of dyestuffs at Columbia University, later continuing it in Germany. He spent some time in the Crefield School of Dyeing and Cloth Finishing, and his first business connection was formed with the Leopold Cassella Company, Frankfort, a.M. From this firm he went to the William J. Matheson Company, in New York, leaving later on to associate himself with the Cassella Color Company.

His work as an instructor began at this point, and for eight years he was in charge of the Chemistry and Dyeing Department of the New Bedford Textile School. Leaving the lecture room, he next played an important part in the building up of the New Bedford & Agawam Finishing Company, of which he was treasurer and general manager. Twelve years ago he became interested in the Franklin Process Company, which was at that time making its debut in the business world. To-day he is the largest stockholder and general manager of the company, having watched its rapid growth to a point where it now has plants in Providence, Philadelphia and in Manchester, England; while the location of a fourth, at present in contemplation, is soon to be announced.

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the
mechanical equipment incidental thereto.

LOUIS A. OLNEY

PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL

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CHEMISTS FAVOR TECHNICAL TEXTILE ASSOCIATION

FRESH proofs of a growing interest in the question of an organization of the technical men of the American textile industry are rapidly making their appearance in the form of letters written by dye and textile chemists, finishers, research workers and others associated with the industry. In fact, perhaps the adjective "growing" were not the proper one to employ in this instance, since it is being demonstrated that a very real interest *already* existed and is now merely finding expression.

Supplementing the correspondence spoken of in these columns last month, much additional comment has lately been forthcoming, and this has been of a character to indicate that the writers are fully alive to the possibilities which such an association holds out. It is worth noting that practically all have been moved to offer suggestions as to membership, form of organization, profitable fields of activity and the like; and it is still more significant to find that while these suggestions differ, they do not conflict.

Should further manifestations of interest warrant, it is the intention of The REPORTER to prepare a tabulation of the suggestions and opinions and publish this for the information of the various trades involved. Should textile chemists who are now considering the possibility of meeting to discuss the projected organization, bring about a gathering early in September, the contributions which we have received will be open for inspection, and it is hoped that by this time they will have become so numerous as to be considered strong evidence of the existing interest. In view of the imminence of such a meeting, therefore, The REPORTER cordially renews its former invitation to those of its readers who may care to communicate with the proper persons with a view to participating, or who may at least desire to offer comment. We thoroughly believe in the advantages of this proposed

organization, and it will be our pleasure to lend whatever aid possible to those engaged in furthering it.

We have before us at present eight letters selected from among others. These contain much that is encouraging, together with suggestions which others interested will want to consider. One of the most important, that of Arthur D. Little, Inc., the Cambridge, Mass., chemical engineers, we present in full elsewhere. From the others we shall quote such portions as are pertinent.

At the very outset one finds food for thought in the letter of a leading textile chemist who has several very definite ideas on the subject of membership, committees, methods of procedure, etc. "Limit active membership to textile chemists and textile engineers," he suggests, maintaining that "outside of the managers, some superintendents and a few overseers, they are the only really scientific, progressive persons in the textile industry.

"In addition to meetings," he continues, "I believe that such an organization could do much valuable work by means of committees—such committees as the following being suggested:

"(a) Standardization of Analytical Processes, (b) Standard Methods of Laboratory Dyeing and Printing, (c) Specifications for the Purchase of Dyes and Chemicals, (d)—if practicable—Standardization of Dyes Domestic and Foreign, and (e) Welfare, Sanitation, Safety Devices, etc.

"Select some existing publication as the official organ of the association and publish the transactions in full."

Another writer suggests: "The results obtained by the British Society of Dyers and Colourists lead me to believe that some modification of their method would make a good working plan."

A textile chemist believes "that a technical association would be an advantage to the textile industry," and is moved to "endorse heartily the suggestion that the first aim should be the determination of standard tests for dyes, chemicals and textile fabrics." This writer would favor the acceptance of such tests by all the leading manufacturers in such lines. "I might also suggest," he continues, "that another field for fruitful investigation would be the actual identification of the hue, strength, and intensity of a color by some numerical figure in relation to definite standards. The adoption of such a system for analyzing and recording the infinite variety of colors on the market would certainly simplify matters for every one concerned."

Another textile chemist says: "There should be incorporated in the working plan of such an organization a broad exchange of technical information through the columns of an official periodical."

A finisher of textile materials says: "There is small doubt but that the American textile industry, especially the dyeing and finishing division, offers an excellent field for technically trained men. In spite of this fact, however, it is an acknowledged fact among mill executives that it is becoming increasingly difficult for us to obtain such men, and an association, such as you have outlined, ought to go a great way toward showing the importance

of the textile industry as a field for technically trained men."

Another leading dye chemist expresses himself emphatically as being in favor of such an organization, and we quote as follows from his letter: "It is simply a matter of whether enough textile and color chemists in this country could be gotten together to form an active and helpful society. The great trouble is that most textile and color chemists are inclined to regard their positions as confidential to their employers, and any questions of fine technique, special methods, and other points that would be of general advancement to the industry as a whole, are kept within the walls of their own laboratories. There are probably a great many who might be glad to join such an organization but unwilling to extend to it the full benefits of their experience; and in addition to this most mill chemists have their time so completely absorbed in the routine of check tests and valuations and similar questions that they have little for the study of technical questions, and particularly for that thoroughness which would justify contributions in the form of papers to a learned society." The same writer says in another part of his letter: "I believe the working plan of such a society should follow that of the American Chemical Society, and if it is to be of national scope the meetings should be held at the centers of the textile industry—say Boston and Philadelphia. A great deal would depend on how the thing was started and upon the inspiration that might come from the success of its first year."

The REPORTER presents these expressions of opinion because they will be of interest to the industry, and also in order that they may stimulate others to comment upon them, at the same time offering helpful criticism and suggestions of their own.

The forthcoming Chemical Exposition, or the week preceding it, may witness the first of a series of meetings leading up to the organization of a technical association of the textile industry. This will be an important event in the history of the industry in America, and we would urge everyone to attend who can possibly do so, in the event that this meeting takes place.

"FLAGRANT POLITICAL MANOEUVERING"

WHETHER the Senate does or does not restore to the Fordney tariff the dye embargo clause stricken out by the House of Representatives, this will not alter the fact that the House *did* vote to leave the country's most important means of defense open to an attack which will make short work of it, once it is allowed to begin.

You read of England, France, Italy, Japan and others eagerly accepting President Harding's invitation to come over and discuss plans for disarmament. This is a laudable project, and if some means can be found whereby all nations can agree simultaneously to cut their existing armaments in half or even smaller, all will be gainers to the tune of many millions of dollars in cold cash, to say nothing of the additional men released for productive work. By arranging such a world movement

on a percentage basis, all participants will have exactly the same relative strength as before—which ought to satisfy them, but won't.

Several years ago it would have been virtually impossible to get the powers even to discuss such a plan. Now they accede readily, will be glad to talk matters over, may actually do something toward carrying a modification of the plan into effect. Has anything happened to change their attitude on this important question outside of the fact that they are extremely hard up and for the time being sick of carnage, anyway?

This, it would seem, is an excellent time for someone to come forward and point out the rather interesting fact that all the powers which have accepted America's invitation to discuss disarmament are the proud possessors of drastic dye embargo laws. And America, who issues the invitation and whom all secretly fear, leaves unguarded her most vital spot.

The nation possessing a well-protected dye industry can safely disarm to a point far below that of another which lacks this single item of armament. In fact, without this item it matters little what else a nation may possess in the way of defenses.

Yet, while cordial acceptances were pouring in from Europe and the Far East, the House of Representatives deliberately chose to throw away the one sure means by which America or any other power can safely enter into a disarmament agreement. That the vote on this subject did not, perhaps, indicate the actual sentiment of the majority of the House; or that considerations other than the strict merits of the measure were temporarily in the ascendancy, does not alter the fact that so far as the House was concerned at that particular time the dye protective legislation was a thing of no moment. Indeed, the very fact that these other considerations were allowed to interfere with an expression of the real sentiments of the House serves only to render such laxity the more—let us say—bewildering.

Ultimate intentions count for a great deal On High, but we of this earth, not gifted with divine perceptions, are forced to judge our fellow men pretty much by actual deeds. And since our Representatives actually *did* this thing, it is no more than fair that they should be judged by that action until, as is not impossible, they give us something fresh to go by when the dye question comes up again.

Of the comments received by The REPORTER regarding the elimination of the dye embargo, none presents a better judgment of this action, nor a better appraisal of its causes, nor yet a more logical summing up of the situation than does the following, from an American manufacturer of dyestuffs. We have selected it for publication in this issue not alone because it makes excellent reading, but because it is educational:

"The menace confronting the American dyestuff industry is unquestioned and should be perfectly evident to anyone with sufficient intelligence to appreciate the facts.

"We are face to face with a similar condition to that which confronted the English dyestuff industry in the latter part of 1920. At that time the method of dyestuff control under the aegis of the Board of Trade, which had been in force since the signing of the armistice, had been wiped out by the celebrated Sankey decision. The British market was wide open, and by the end of 1920 the German dyestuff manufacturers had dumped between twenty-five and thirty millions of dollars worth of dyestuffs into that country.

"Owing to the depression in general trade—worse there even than it is here—this vast quantity of dyestuffs is still largely waiting to be absorbed and there is no doubt that if we do not awaken to the necessity of repairing our own fences, a large part of it will find its way here as soon as the Emergency Act lapses on August 28.

"The effect in Great Britain was to practically destroy the dyestuff industry for the time being, and to-day the British Dyes, Ltd., and all the other dye manufacturers are shut down. Great Britain took alarm at this situation and even those selfish manufacturers whose only interest it is to buy their dyes at the lowest possible price no matter where they come from, were shocked into a realization of the danger facing the organic chemical industry of Great Britain.

"Although that is a free-trade country and is constitutionally opposed to protective measures of any kind, an embargo bill was introduced in Parliament, and, after a brief discussion and inquiry, lasting only twenty-eight days, was passed, carrying a complete prohibition of the importation of foreign dyes competing with British-made products for a period of ten years.

"It may be that we shall have to learn the same lesson, but learn it we shall, if the same conditions are imposed upon us.

"If the adverse vote in the House of Representatives could be considered as having been taken after careful, deliberate and painstaking investigation of the subject, one might feel that it had the merit of good faith. But it was not taken on any such basis.

"The sponsor of the protective legislation for the dyestuff industry, Mr. Longworth, endeavored to get in a last word in behalf of the proposed legislation, but was prevented by Mr. Frear of Wisconsin, who is the recognized spokesman for the Wisconsin German interests. The vote was taken on party lines, except that the Democratic vote was assisted by practically all those legislators who in 1917, including Mr. Frear, voted against this country entering the war.

"In addition to this solid phalanx, there were a few disgruntled Republicans who resented Mr. Longworth's action in voting against a duty on hides and oil. The vote on the dyestuff question was not taken on the merits of the situation, but was a flagrant piece of political manoeuvring.

"These legislators were willing, in order to gratify private spite and political prejudice, to leave the United States of America the only great nation which has failed

to protect itself against German domination in the organic chemical industry, with all that that means for the welfare of the country in the production of pharmaceuticals, necessary dyestuffs, munitions of war, and the vast amount of chemical research which is necessary for all our industrial activities.

"During the taking of the vote the German lobby cast decency to the winds, and one member thereof actually appeared on the floor of the House, making his final arrangements to whip his supporters into line. Immediately after the vote was announced, the Democratic minority and the one lone Russian-born Socialist, applauded and cheered the result.

"Is this not a spectacle to make anyone who has the future welfare of this country at heart, and who thinks the preservation of this essential industry is a matter of patriotic necessity, look to the future with apprehension and shame?"

ATTEND AND SUPPORT THE A. C. S. DYE DIVISION NEXT MONTH

AN event of importance to the dye industry will take place on Wednesday and Thursday, September 7 and 8, when the Dye Division of the American Chemical Society will hold its Fall Meeting in New York City. This and other divisional meetings are to be held in the buildings of Columbia University.

In addition to the usual scientific program, there will be an election of officers, and Secretary R. Norris Shreve announces that several matters of interest to the Dye Division will come up for discussion.

A special plea is made to all members to inform the Secretary at once concerning papers to be presented dealing with the chemistry of the manufacture, use or application of dyes and intermediates. A special effort is to be made this year to secure papers of unusual interest.

Not the least important, in view of recent events, is the fact that the meeting will take under discussion the dye embargo provision of the Fordney tariff, which was removed by action of the House and which, it is strongly hoped at this writing, will be restored by the Senate. Dye chemists need no reminder of the probability that whatever action the Senate may take in regard to this vital measure, the reversal of its legislative program so as to give tax revision precedence over tariff legislation, will prohibit final action of any description on the Fordney bill before this meeting is held. Resolutions will be in order, and in the meantime all members are urged to write to their Senators and Representatives, asking for the enactment of the dye protection paragraph of the bill substantially as recommended by the House Ways and Means Committee.

We wish to add our own plea to that of Secretary Shreve for an active interest in this meeting. If you are not already a member of the organization, an application blank will be found among the advertising pages of this issue. If you are a member, follow the suggestion of the Secretary by immediately writing to Washington. In

case you have done so before, remember that there is absolutely no rule which prohibits you from doing so again, and that this is the most effective kind of support you can lend those who are working for the passage of this important measure. And, finally, plan to present a paper at the meeting, any further particulars concerning which you may obtain by addressing Mr. Shreve at 43 Fifth Avenue, New York City.

Suggest "Textile Testing Section" for Technical Association

THE following letter from the firm of Arthur D. Little, Inc., of Cambridge, Mass., referred to on the editorial page of this issue, is as follows:

My attention has just been called to an article appearing in the June number of The AMERICAN DYESTUFF REPORTER, concerning a proposed "Technical Association for the American Textile Industry." I am writing to assure you of the interest of this organization and my personal interest in such an association.

One line of activity which seemed to me to be of particular interest would be the formation of a section of this association for the "Testing of Textile Materials." The engineering profession already has an active society for the testing of materials, which studies and prepares specifications for all kinds of materials used in engineering. It seems to me that the textile industry has an equal need for such an organization; but that it could do its work better as a section of such an organization as you propose than as a separate society.

The work of such a section should be divided among various committees, as is done in the American Society for Testing Materials. As a suggestion, the following might serve as possible committees dealing particularly with dyestuffs. Other committees would be formed for the preparation of standards for fibers, sizes and other materials:

1. Committee for the standardization of methods for testing the fastness of colors. Such a committee would study various tests and apparatus for determining the fastness of colors, and would decide upon definite means of expressing the results of such tests.

2. Committee for the standardization of methods for the determination of tinctorial power and color measurements.

3. Committee for the standardization of color nomenclature. It seems to me that this committee would be very important. At present only a small part of the dyes on the American market are sold under names which give any true idea as to their constitution or properties, but are rather sold under trade names invented by each manufacturer for his own use. In the case of the old German dyes definite trade names were used, and these were catalogued in books like Schultz's Farbstofftabellen. From such a publication anyone desiring to could find out the

exact chemical and physical nature of any dyestuff.

The work of the committee on standard nomenclature would consist at first in trying to persuade the dyestuff manufacturer to sell dyes under definite, well-known names, or to give other information enabling one to identify them. Secondly, to prepare tables of these dyestuffs, arranging them in such a form that this material would be accessible. A great deal of material is at present available, but is so scattered that it is hard to find.

4. Committee for the establishment of definite means of dye identification.

These are just a few suggestions concerning a part of the work in the dye section, which would be expanded and added to as needed.

Yours very truly,

ARTHUR D. LITTLE, INC.

By Wallace J. Murray.

The Uses of Copper Salts

(Continued from page 20.)

When copper sulphate solution is added to a solution of potassium iodide, iodine is liberated.



It is easy to estimate the liberated iodine by means of a standard solution of sodium thiosulphate, and so obtain a measure of the copper which has taken part in the reaction.

A standard decinormal solution of sodium thiosulphate is prepared by dissolving 24.8 grams of the pure crystalline salt to a total volume of one liter.

If copper sulphate be the sample on which the analysis is being carried out, then 28.7 grams should be dissolved to one liter. In the case of other salts proportionate quantities should be used. Twenty cubic centimeters of the solution of copper sulphate are then diluted to 100 c.c. with distilled water, and a dilute solution of sodium carbonate is added until a slight permanent precipitate of copper carbonate is obtained. Acetic acid is then added so as to just dissolve the precipitate.

In this way any free mineral acid is neutralized, since its presence would interfere with the estimation. A slight excess of acetic acid is less harmful.

To the copper solution are now added 20 c.c. of a 25 per cent solution of potassium iodide. White cuprous iodide is immediately precipitated, but the solution appears brown because of the liberated iodine.

The standard sodium thiosulphate solution is then run into the flask from a burette until nearly all the iodine has been absorbed. A few drops of a starch paste may then be added, and the addition of the thiosulphate solution is continued till the blue coloration which has developed just disappears.

Then—copper sulphate

$(\text{CuSO}_4 \cdot 7\text{H}_2\text{O})$ in sample = $5 \times$ No. of c.c.'s of sodium thiosulphate solution required.

GRAVIMETRIC PROCESS

In exceptional cases it may be desirable to estimate the copper by a gravimetric rather than by a volumetric process. In such instances the copper must be brought into solution by any suitable method (heating with dilute hydrochloric or nitric acids is often convenient) and to this must be added, while boiling, a solution of caustic soda. All the copper will be precipitated as the hydroxide, and should then be filtered off and well washed on the filter. The precipitate may be then strongly ignited in a crucible, cooled, and moistened with nitric acid. After a further ignition the precipitate will consist of copper oxide, CuO , and may be weighed as such.

Copper salts are usually cheap and are not therefore liable to much adulteration. But this fact should not prevent dyers from testing the salts which they use, since it is only by systematic testing that dyeing processes can be made to yield uniform results.—*Dyer and Calico Printer.*

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

C. C. D.—Question: A friend of mine recently changed the grade of salt he had been using in dyeing silk hose but finds that the new salt, which is a fine Louisiana rock salt, does not exhaust the bath nearly as well as the salt he formerly used. Samples of both are being sent you under separate cover. Can you advise me the reasons for the difference in action and what, if anything, can be done to make the Louisiana salt work right?

Answer: An analysis of the two samples of salt which you sent us would seem to show that neither one of them is what might be called a good quality of salt. The granulated salt is of better quality than the other, but contains a considerable amount of sand. The Louisiana salt is nothing but a very poor grade of rock salt, and is also adulterated with sand; that are also present some impurities of an alkaline nature in this Louisiana salt, which would certainly not improve its action.

We do not know what price you are paying for the salt in question, but a perfectly soluble and clean salt can be bought for in the neighborhood of \$17 to \$19 a ton. If, however, you have on hand a large quantity of the Louisiana salt which you must dispose of, we would

suggest that you use two and one-half to three times the quantity that you have been using of the other salt; this ought to give approximately the same results. It would also be advisable to let your salt solution stand for a while after dissolving, so as to allow the sand to settle to the bottom of the tank.

C. L. G. Z.—Question: Am enclosing the remains of a swatch which has been treated with a 10 per cent solution of caustic potash. This remains consists of cotton and shoddy. Could you tell me just what this shoddy is? I claim it is wool shoddy; while another chemist claims that if it were such it would have boiled out. He maintains that it is either jute or linen. Which one of us is correct?

(2) Is there any book which will tell me how to test for dyestuffs in materials?

Answer: No wool could remain in this material if it had been boiled out with 10 per cent solution of caustic potash; therefore, no real wool shoddy could be present in the material which you submit. It would be a difficult matter to ascertain whether this material is jute or linen, because the two are quite similar in the raw state, and after they are dyed black it would be extremely difficult to differentiate between them. The relative cost of jute being less than that of linen, we should suppose the former to be present rather than linen, although this would not necessarily be so. With the undyed and untreated material it might be possible to determine whether the fiber was jute or linen.

In reply to Question No. 2 we would suggest that the following books be consulted: "Manual of Dyeing," by Knecht, Rawson and Lowenthal; "Analysis of Dyestuffs," by A. G. Green, and "Testing of Dyes in the Laboratory," by C. M. Whittaker.

A. S.—Question: Please advise as to the construction of boil-off kiers for cotton yarns, capacity 800 pounds.

Answer: Boil-off kiers for bleaching cotton, of modern types, consist of iron boils, usually upright in position and provided with some device for circulating the bleaching liquor through the material—yarn in your case—at a boiling temperature. These kiers may work either under pressure of steam or under atmospheric pressure. The former are known as pressure kiers, while the latter are known as open kiers.

The pressure kiers are the most effective and reduce the time of boiling to a minimum, but open kiers are very extensively used in the bleaching of yarn, as the process may be controlled somewhat the more easily. The circulation may be maintained by the steam injector—some steam pressure device like the Jefferson kier, for instance—or by direct circulation by means of a suitable rotary pump. The pump system is strongly recommended for yarn. An upright cylindrical kier, 4 to 6 feet in diameter and 5 to 8 feet high, would give a range which would be large enough for the bleaching of 800 pounds of yarn under varying conditions.

C. H. H.—Question: Which method of dyeing chrome colors gives the best fastness to fulling; also what are the advantages of the different methods?

Answer: There is little doubt that after-chromed dyeings resist fulling better than the same dyes applied monochrome or on a chrome mordant, as the dyestuff has had a chance to penetrate the fibers, from the acid bath, and is then converted into the insoluble condition by the bichromate, generally undergoing oxidation at the same time. There is a great possibility in the single-bath and chrome-mordant processes that the dye will be fixed on the surface of the fiber only, in which case, even if it is insoluble, it is more likely to be removed by the mechanical action of fulling.

Dyeing on a chrome mordant is necessary with dyestuffs that are true mordant dyes and cannot be dyed from an acid bath. The alizarines and the gallocyanine series are of this sort. Their fastness depends on the character of the mordant and the evenness of the dyeing. The mordant, except in the case of logwood and other vegetable dyes, should be free from chromic acid, which destroys the bisulphite used to make the dye soluble, and results in a colloidal adsorption on the surface rather than a true penetrated dyeing. The dyeing should proceed slowly with only gradual rise of temperature and, after exhaust, should be followed by prolonged boiling in a neutral bath to complete the union of dye and mordant.

The one-bath chrome process is simply a convenience for matching shades readily, and is generally used on slubbing and pieces where evenness is important. It is also used where silk effects are to be left white, but in this case has no advantage whatever over the after-chrome method. The fastness to fulling is less than with the same dyes after-chromed. Certain conditions and requirements of the goods themselves will often compel the dyer to use one or another of these processes, so that the matter finally rests with his judgment, regardless of any other considerations.

J. S.—Question: Many of my shades on wool turn redder in artificial light and no longer match the sample. How can I avoid this?

Answer: There are a number of acid dyestuffs that change shade and affect whatever combinations they may be present in. Acid Violet 4B is probably the worst offender, but if it is used with Patent Blue A or V, or even Wool Green S, in proper proportion, the change is counteracted by the other color. Many of the acid reds will also cause the dyeing to change, and cases have been known of even the yellows and oranges affecting the shade in artificial light. The only remedy is to use dyes that do not change, or else make combinations in which the change in one dye offsets the change of the others. Such matters are usually adjusted by the laboratories of the dyestuff houses, and we advise you to bring your troubles to their attention before ordering your next supply of dyes.

T. A. E.—Question: What class of dyes are used for coloring celluloid?

Answer: Any dyestuff that is soluble in alcohol may be used. Basic, acid and direct dyes are used and incorporated in the mass when the material is made. Their fastness to light has no relation to their fastness when dyed on textile fibers, as some of the fastest dyes on wool are found to be very fugitive in celluloid, and vice versa.

Review of Recent Literature

"Anthracene and Anthraquinone." E. de Barry Barnett, B.Sc., F.I.C. 447 pages, 5½ x 8½. \$6.00. New York, D. Van Nostrand Company.

Issued as the latest addition to the series under the general heading "Industrial Chemistry" edited by Samuel Rideal, this work will be received as a valuable and timely contribution to the none too profuse authoritative literature dealing with the chemistry of the anthracene derivatives, and is admirably calculated to accomplish its avowed purpose of stimulating research work on the innumerable patent claims by senior students in the universities and others. The author, formerly Research Chemist to Levinstein, Ltd., is Lecturer in Organic Chemistry at the Sir John Cass Technical Institute, and has published as part of the same series his "Coal-Tar Dyes and Intermediates" and "Explosives."

The present work has been prepared from the author's own private notes, and presents an exhaustive account of the anthracene derivatives arranged in their logical sequence, although it should be noted that such naturally occurring derivatives as chrysarobin have purposely been omitted by reason of the fact that an up-to-date account of these substances has recently appeared in "Natural Organic Coloring Matters," by Perkin and Everest. The introduction provides a historical sketch of anthracene, with brief notes on dyeing for the reader who has not studied tinctorial chemistry; a note of the commercial names now in use, and the relation of color to constitution in the various classes of anthraquinone derivatives. Throughout the work the author employs, in the main, his own adaptation of Pfaff's system of notation; but this is so simple and the explanation at the outset so clear, that the reader should experience no difficulty whatever in grasping it.

The principal contents include: Anthracene and Its Homologues—Simple Derivatives of Anthracene—The Anthraquinones and Dianthraquinonyls—Anthrone, Anthranol and Allied Products—Anthraquinone Ring Syntheses—The Benzanthraquinones—The Aldehydes, Ketones and Carboxylic Acids—The Nitro, Nitroso and Halogen Anthraquinones—The Sulphonic Acids, Mercaptans and Sulphides—The Amino Anthraquinones and Dianthraquinonylamines—The Hydroxy and Aminohy-

droxy Anthraquinones and Ethers—Pyridine and Quinoline Derivatives—The Acridones, Xanthenes and Thioxanthenes—The Benzantrones—The Cyclic Azines and Hydroazines—Miscellaneous Heterocyclic Compounds—Miscellaneous Compounds.

In view of the fact that it is now more than forty years since Auerbach published his "Das Anthracen und seine Derivate," and that during the intervening period—particularly the last fifteen years—there have been enormous advances in our knowledge of the chemistry of the anthracene derivatives; and that, despite this, much of the research work which has been carried out has appeared only in the form of patent specifications and for that reason has escaped the attention which it merits, it would appear that such a work as the present has been overdue these many months. Certain it is that this volume will fill a distinct want, and that the author is entitled to the applause of coal-tar chemists and students, both here and abroad, for stepping so opportunely into the breach.

"The Fundamental Processes of Dye Chemistry." H. E. Fierz-David, translated by F. A. Mason. 254 page; 45 illustrations, including 19 plates. London, J. & A. Churchill.

The appearance of an excellent translation of Professor Fierz-David's "Grundlegende Operationen der Farbenchemie," published toward the end of 1919, should be welcomed by all interested in color chemistry who do not already possess a copy of this valuable book. The translator has corrected some slight errors which occurred in the original Swiss edition, but otherwise the book remains practically unaltered, and is copiously illustrated with plates and diagrams of apparatus and plant. The book is essentially practical and is divided into four sections. The first section deals with a number of well-chosen examples of the preparation of typical intermediate products by sulphonation, nitration, reduction, chlorination, oxidation and condensation. The second section is devoted to the preparation of a number of azo and triphenylmethane dyes, sulphur melts and miscellaneous dyes, including Sandmeyer's synthesis of indigotin. In both these sections, in addition to laboratory details, the methods of carrying out the processes on a works scale are clearly indicated. In fact, the preparations described are technical processes in miniature, as distinct from purely laboratory processes, and consequently are of particular value to the student of dye chemistry. In the third section the technical details of vacuum distillation, the construction and use of autoclaves, the structural materials used in dye chemistry, and the question of works management are discussed. The translator has wisely refrained from attempting to convert the prices quoted in the original, and it should be remembered that these refer usually to pre-war conditions in Switzerland. The fourth section deals briefly with the analytical control of certain intermediate products.

"Worsted Spinning" (Die Kammgarnspinnerei). R. Preu. 198 pages. 6 x 10. Berlin, Gebrüder Borntraeger.

The fact that there are now in print few good books on worsted spinning, to which qualification the present can justly lay claim, makes it a particularly welcome addition to textile literature at the present time. The text is in German, and the author, an Engineer at the Prussian Technical School, Aachen, has succeeded, without attempting to treat his subject exhaustively, in condensing within a small space a valuable fund of information relating to worsted spinning in great detail.

The contents of the volume are arranged under the following heads: Introduction; wool; spinning; half-worsted yarn; twisting; reeling; steaming; yarn testing; worsted waste; air moistening; power consumption; fundamentals of algebra. There are 157 illustrations in the body of the work and 16 plates in an appendix. A commendable feature is the chapter on the fundamentals of algebra, which is of special value to the large number of worsted mill men who have not had the opportunity to study the mathematics of textile process with an instructor.

"Fixation of Basic Dyes on Tannin by Steaming." A. Steigler. "Bulletin" of the Societe Industrielle de Mulhouse; 1920; p. 173.

This article describes a method of fixing basic colors on tannin without the treatment with tartar emetic. A paste is made containing 30 grams of basic dye, 100 grams of lactic acid, 500 grams tragacanth thickener, 180 grams of tannin solution (1:1), 20 grams of lead acetate and 170 c.c. of water. This is printed on the goods, steamed for one hour, rinsed, soaped and chemicked. In preparing the paste the lead acetate solution is added last, and the lactic acid is used to prevent the formation of the lead lake before the material is steamed. These lead lakes are as fast to soap and light as the antimony lakes, and are deeper in shade, although of equal purity and brightness of color. Zinc acetate may be used in place of the lead salt, but the lakes obtained in this manner have less fastness to soaping and bleaching. It is reported that this process can be applied to naphthol prepared cloth as well as unmordanted material, and may be recommended from the point of view of economy, but it has the drawback in that the lead lakes are sensitive to sulphureted hydrogen, so that bright shades will soon become dulled.

"Practice of Color Chemistry" (Farbenchemisches Praktikum). Dr. Richard Moehlan and Dr. Hans Th. Bucherer. 367 pages, 5½ x 9. Berlin, Walter de Gruyter & Co.

Particularly adapted to the uses of research chemist and student of color chemistry, this volume is worthy the attention of those seeking additional literature dealing with both the manufacture and the application of dyestuffs. The text is in German, and the principal contents include sections dealing with coal tar, raw materials and intermediates, chemicals used in the manufac-

ture of coal-tar colors, dyestuffs, application of colors to textile fibers, identification of coal-tar colors in the substance and on the fiber, and testing colors for fastness.

Recent Patents

Composition for Dyeing Animal Fiber (1,383,092; June 28, 1921)

JOHN H. FIEBIGER

A dyeing composition comprising a quantity of an aniline acid coloring material mixed with a quantity (not greater than five times the quantity of the coloring material) of an organic acid; and a quantity of a diluent.

Solvent for Dyestuffs (1,379,175; May 24, 1921)

HERBERT A. FOLSOM

A process of dissolving vat colors and sulphur colors consisting in mixing the color to be dissolved with water, an alkali and a sulphite waste liquor.

Treatment of Textile Fibers and Fabrics (1,379,381; May 24, 1921)

CARL BENNERT (assignor, by mesne assignments, to the Chemical Foundation, Inc.)

The process of cleansing textile fabric which comprises immersing said fabric in a solution consisting of an albumose cleansing compound derived from casein.

Process for Dyeing Cellulose Acetates (1,378,443; May 17, 1921)

RENE CLAVEL

The herein described process for dyeing cellulose acetates, consisting in carrying out the dyeing operation with a dyestuff solution which contains a weak acid and at least one soluble chloride.

Process of Bleaching Vegetable Fibers (1,381,440; June 14, 1921)

GEORGE H. TAYLOR (assignor to American Writing Paper Company, Holyoke, Mass.)

Process of bleaching vegetable fibers, comprising subjecting the fiber to a hypochlorite in presence of free boric acid, the latter in less than the equimolecular proportion to the hypochlorite.

Azo Dyestuffs Dyeing on Mordants (1,382,196; June 21, 1921)

CARL JAGERSPACHER (assignor to Society of Chemical Industry in Basle, Basle, Switzerland)

As new products the herein described azo dyestuffs

dyeing on mordants, derived from aromatic orthoxydiazocompounds and a monoalphaoxynaphthalene-sulphocarboxylic acid, which combines with diazocompounds in the ortho position relatively to the hydroxyl group, without splitting off the carboxyl group, which constitute in a dry state dark powders dissolving in water and in concentrated sulphuric acid with red to violet colorations, dye wool in an acid bath red to brown tints becoming on subsequent chroming, red to violet fast to fulling and to potting and produce, when printed on cotton with chromium mordants, red to violet tints fast to soaping, chlorine and light.

Apparatus for Bleaching, Dyeing, Etc. (1,383,021; June 28, 1921)

MAX POETZSCH

An apparatus for bleaching, dyeing, etc., comprising a liquid-containing vat, means for feeding cloth into the vat and removing the cloth from the vat in a continuous movement, and means for longitudinally refolding the cloth each time it passes over said feeding means.

Apparatus for Dyeing (1,378,618; May 17, 1921)

CHARLES H. ROBBINS (assignor to C. H. Claflin Company, Boston, Mass.)

The combination with a dye vat having a perforated false bottom, a circulating pipe for the dye liquor having a branch extending downwardly into said vat, and a spraying device freely revoluble about the lower end of said branch pipe above the liquor and provided with means for ejecting jets downwardly onto said liquor and at an angle thereto.

Method of Preparing Sulphur Black and the Product Thereof (1,383,071; June 28, 1921)

ALBERT C. BURRAGE, JR., and GUIDO MEISEL (assignors to Atlantic Dyestuff Company, Burrage, Mass.)

The method of preparing sulphur black which comprises filtration of water of suspension from the solid color, followed by partial evaporation of the water remaining adherent to the color after filtration, until the color assumes a moist, powdery consistency.

Sulphur Black (1,383,072; June 28, 1921)

ALBERT C. BURRAGE, JR., and GUIDO MEISEL (assignors to Atlantic Dyestuff Company, Burrage, Mass.)

Sulphur black associated with water and a solid soluble comminuted modified uniformly distributed through it.

Sulphur black containing water distributed through the solid color in quantity consistent with uniform mixture of a solid soluble comminuted modifier with the color.

Sulphur black associated with water and solid comminuted salt uniformly distributed through it.

Color-Printing Mechanism

(1,383,253; June 28, 1921)

CLINTON ALVORD

In a device of the class described, the combination of means for holding under tension yarn arranged in bights, and automatic means for printing said yarn at variably spaced apart intervals.

In combination, automatic means operable to move yarn variable distances and a color mechanism operable to contact the yarn.

In a device of the class described, the combination of a yarn support, a color-stripping mechanism for applying stripes to the yarn supported by said support, a color ridge remover, and means associated with said mechanism for automatically actuating said ridge remover.

Waterproofing Composition

(1,383,068; June 28, 1921)

THEODORE BOSSHARD

A waterproofing composition, including gelatine, water and glycerine in the proportion of $\frac{1}{2}$ pound gelatine, 18 ounces water and 9 ounces glycerine.

Manufacture of Naphthols

(1,381,280; June 14, 1921)

LEO F. CHEBOTAREF (assignor, by mesne assignments, to National Aniline & Chemical Company, New York)

The process of making basic sodium naphtholate which consists in mixing fifteen parts of sodium salt of naphthalene-beta-sulphonic acid with eleven parts of caustic soda, fusing at a temperature between 280 and 350 deg. Cent., and removing the upper layer formed on prolonged heating.

Machine for Pulping Plants Containing Textile Fibers

(1,381,830; June 14, 1921)

ANDRE HAUSER

A machine of the character described, including a supporting frame, a table having a protected extension, a scraping drum rotatably mounted on the frame and co-acting with the extension, means for feeding plants between the drum and the table, co-acting crushing rollers rotatably mounted in the frame, conveying means between the scraping drum and the crushing rollers, a secondary table beneath the rollers, a protecting strip on the lower portion of the table, a secondary scraping drum for co-acting with the strip on the table, a rotatably mounted conveying drum for

receiving material from the secondary drum, and squeezing rollers rotatably mounted in the frame between which material is passed from the conveying drum.

Rosin Size Solution

(1,382,346; June 21, 1921)

JUDSON A. DE CEW (assignor to Process Engineers, Inc., New York)

A sizing composition having therein a drying oil, soap made from a drying oil, rosin and rosin soap.

Apparatus for Drying Yarn or the Like

(1,383,510; July 5, 1921)

GREENWOOD BAILEY (assignor to Herbert Foster Anderson, Bradford, England)

In apparatus for drying hanks of yarn, a chamber, cylinders mounted in said chamber, supports for one end of each of said cylinders, means for rotating said cylinders, guide rolls mounted in said chamber, guide rolls mounted outside said chamber at the feeding end, guide rolls mounted outside said chamber at the discharge end, endless tapes passing over said cylinders and guide rolls, slots in the walls of said chamber to allow ingress and egress of said tapes, a heating chamber adjoining said chamber, a heating device in said heating chamber, slots in the walls of said chambers opposite to said cylinders, and means for circulating air through said chambers.

Treating Hanks of Yarn with Liquid

(1,383,800; July 5, 1921)

HEINRICH HABLUTZEL-FREI

In an arrangement for treating hanks of yarn with a liquid contained in a trough, a frame movable over the trough, a pair of endless flexible conveying members provided with double hooked members and forming inclined slopes for lifting and lowering the hank carriers engaged by said hooked members, and means provided in front of said slopes for lifting the hank carriers off the hooked members and the conveying members and for placing them at some distance from the descending slope.

Process for Manufacturing a Wool Substitute from Cellulose and Similar Solutions

(1,383,742; July 5, 1921)

PAUL HERMANN MINCK (assignor to the Chemical Foundation, Inc.)

A process for the manufacture of a wool substitute which comprises dissolving cellulose, squirting the cellulose solution through a spinning nozzle into a precipitating bath, and removing the chemicals from the formed thread by passing said thread through a dripping bath under a tension produced by the kinetic energy of the falling bath liquid.

Textile and Like Printing Machine

(1,378,278; May 17, 1921)

CHARLES ROBERTS (assignor to the Calico Printers' Association, Ltd., Manchester, England)

Means for cleansing the surface of proof covered bowls in printing machines, consisting of the combination with a casing having a compartment therein formed by a longitudinal division piece with an extension, of a scraping device upon said extension engaging the bowl, means supplying liquid to said compartment, an outlet passage for the liquid extending across the compartment adjacent the bowl surface and in advance of the scraping device, a plate upon said casing engaging the bowl surface, a further compartment in said casing, means placing said compartment under vacuum, a communicating passage between said vacuum compartment and the surface of the bowl in part formed by said plate and at the rear side of the scraping device, a supplementary vacuum compartment or cavity at the rear side of said plate and a doctor engaging the bowl at the rear side of said compartment, as set forth.

Apparatus for Preparing Textile-Treating Baths

(1,380,282; May 31, 1921)

THEODORE WICKERSHAM

In apparatus for preparing a treating bath, the combination of a tank, means for heating the same, liquid containers mounted above the tank and having discharge pipes leading to the tank, a perforated pipe in the bottom of the tank for collection of the material contained therein, a perforated pipe in the top of the tank for the inlet of such material, a pump connected to said pipes for drawing the material from the bottom of the tank and discharging it into the top of the same to insure proper circulation and emulsification thereof, and means for discharging the material from the tank.

Process for Solvent Recovery

(1,381,002; June 7, 1921)

ARTHUR SAMUEL O'NEIL

In the recovery of solvents, which when vaporized in a gas atmosphere produce vapor mixtures substantially heavier than the said gas atmosphere alone, the process of allowing a current of heated gas to pass in contact with material carrying such solvent to be recovered, and then allowing the solvent-laden gas current to travel downwardly through a tortuous passage containing liquid solvent in a refrigerated condition, in direct contact with said solvent-vapor-laden gas current, and allowing the gas to repeat the cycle of operations, the travel of the gas vehicle being effected solely by the gas-heating operation and the contact with the refrigerated solvent.

FASTNESS OF CHROME DYEINGS TO FULLING

It happens sometimes that dyeings on wool after-treated with chrome, and which are presumably capable of resisting fulling, will show the bleeding of the color during the fulling operation. The cause of this defect generally lies in the material to be dyed.

For instance, shoddy or remanufactured wool is very frequently present in large quantities, and if this material has previously been dyed with a color that is not fast it will, of course, not withstand fulling, even though topped with a mordant dyestuff. The material should be vigorously tested by washing a sample with a solution of soda ash and soap, and if any of the color bleeds out of the shoddy it should be properly stripped before dyeing with the chrome dyestuff. Such treatment may consist in washing the goods in a lukewarm solution of soda until no more color bleeds off. Preferably, however, owing to the fact that alkaline treatment will more or less damage the fiber, the color on the shoddy should be removed by the application of a suitable stripping agent, such as zinc and bisulphite of soda, or hydrosulphite. The use of such a stripping agent also presents the advantage that it leaves the goods much lighter in color, and therefore in a better state for taking clear and light shades. If the fault cannot be traced to the presence of colored shoddy, the defective fastness of the chrome-dyed wool to fulling may be due to grease.

Crotona Fast Chrome Black W V

Like its prototype Diamond Black F, it possesses remarkable fastness to milling, rubbing, light, acids and alkalies. It can be used without detriment in the presence of metals and is suitable for machine dyeing.

Croton Color & Chemical Co.

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293 BROADWAY, NEW YORK

Works: Croton-on-Hudson, N. Y.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 9, NO. 10
SEPT. 5, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

In view of the fact that active measures are now being taken by several leading textile chemists looking to the organization of an Association of Textile Chemists and Colorists, Professor Louis A. Olney's views on this subject, which appear as the leading article herein, should be of unusual interest.

In an article on "The Bichromates and Wool Dyeing"—the first of a series—Winthrop C. Durfee, the well-known authority on mordants and mordant dyeing, deals with the little understood reactions involved in the use of chromates as wool mordants.

A paper on "Causes of Cloudy and Shady Effects in Worsted Piece Dyes," by Karl R. Moore, Chemist, Stillwater Worsted Company, describes the principal causes of defects of this character and indicates means for their elimination.

Complete table of contents will be found on page 15.

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

Vol. 9, No. 10

NEW YORK, SEPTEMBER 5, 1921

Section 2

Standard Methods of Dye Testing and an American Association of Textile and Color Chemists

How the Former May Be Obtained Through the Latter—Why an American Association Is the Logical Body for the Determination of Standards—Objects and Membership—Hampering Traditions on the Wane

By LOUIS A. OLNEY

Professor of Chemistry and Dyeing, Lowell Textile School; President, Stirling Mills, Lowell, Mass.

JUST a year ago the author published a plea for greater efforts toward the standardization of methods of dye testing and uniform methods of recording such tests.

That article created considerable interest not only on the part of individuals but also several of the National Textile Associations, which expressed an interest and willingness to co-operate, if the proper agency could be created and means provided for carrying on the required laboratory work and furnishing the necessary clerical assistance that would be involved.

A study of the organization of the National Textile Associations indicated that for the most part they were not in a position to undertake the immediate supervision and execution of such a task, but could render financial assistance to, and officially recognize, an association of men qualified to devise and establish such standard methods.

AN AMERICAN ASSOCIATION NEEDED

The logical body for the supervision of such work would be an officially organized American Association of Textile and Color Chemists. Such an organization has been proposed at various times during the past ten years, but until recently no active measures have been taken toward its organization.

With the prospect that such an association may be created in the near future it might be well to discuss some of the features which would tend towards its success as well as a few which might temporarily, though not permanently, interfere with its growth.

In many respects the British Society of Dyers and

Colourists might serve as a model for the development of an American society. As a matter of fact, the organization of an American section of this Society was proposed a few years ago. The idea was well received but the consensus of opinion at that time was, and it seems to be even more pronounced to-day, that American textile chemists and colorists are sufficiently numerous, intelligent and ambitious to prefer an organization of their own, although the line of least resistance would undoubtedly be to establish an American section of a well-organized foreign society.

GEOGRAPHICAL LIMITATIONS

It has also been proposed that a Section of Dyeing, Bleaching and Finishing be established in connection with the American Chemical Society. The writer was a very strong advocate of this plan a few years ago, but, through observation and study of conditions, is now convinced that this would not be the best procedure. In the first place, the meetings of the American Chemical Society would not geographically adapt themselves to the requirements of the textile chemists more than once in every two or three years. While exact figures cannot be given it is safe to say that 80 per cent of the dyeing, bleaching, printing and finishing industries are located within a circle having a radius of 175 miles which would include Boston, New York and Philadelphia. Out of thirty pages devoted to Dyers, Bleachers and Finishers in a recent edition of Davison's Blue Book, twenty-six were from Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and the eastern portion of Pennsylvania.

CONCENTRATION OF EFFORT AN ADVANTAGE

In the second place, the membership of the American Chemical Society has grown to such an extent that future meetings will have an average attendance of 1,500. At these meetings the program is so filled with assemblies and matters of general interest that the individual interests are almost entirely lost. For these reasons there is little doubt that an intensive meeting of textile and color chemists extending over a period not exceeding two days would accomplish much more for the general interests of those concerned. Another reason, perhaps more important than either of those already mentioned, is that a small section of a very large organization can never develop the same degree of interest and responsibility among its members, nor the freedom and effectiveness of action, that is possible with a small but representative organization that is complete within itself.

Assuming that an independent organization is desirable, the following questions may well be asked:

First: What should be its objects?

Second: How should it be constituted?

OBJECTS

The fundamental objects of such an organization should be:

First: To promote the scientific and technical interests of its members in regard to the properties and application of dyes, and the processes of scouring, bleaching, and finishing.

Second: To endeavor to develop a closer relationship between theory and practice in the application of dyes and of the great variety of other chemicals used in the textile industry.

Third: To render service to the textile and color industries of the country by developing standard methods of testing and identifying dyes and of analyzing textile materials in general and, as far as possible, of standardizing systems of recording and reporting such tests and analyses. An attempt to establish a more nearly standard nomenclature and use of terms for textile chemists and colorists might well be included under this heading.

Fourth: To encourage research work and investigations, especially along lines of textile chemistry and coloring, which, for one reason or another, are not ordinarily undertaken by the laboratories of the textile and color manufacturing plants. Work of this kind might be stimulated, as has been the case with the British Society of Dyers and Colourists, by offering medals, cash prizes or some other form of recognition for the satisfactory solution of certain problems, and excellence of papers or other publications along certain specified lines.

Finally, to look forward to and hasten the time when there may be established in this country a specialized and as complete a library as possible of publications in regard to textile chemistry, scouring, bleaching, dyeing, printing and finishing with a comprehensive and well maintained card index primarily for the consultation of its members.

At first thought these objects may appear somewhat Utopian, but it must not be expected that they will develop over night. Much time and thought will be necessary, but if after ten years these objects should obtain, the time spent and the effort made would have been well worth while.

MEMBERSHIP

In order that such an association might develop along the lines mentioned, three types of members would be necessary.

First: Regular or active members.

Second: Junior or student members.

Third: Sustaining or corporation members.

ACTIVE AND JUNIOR MEMBERSHIPS

The first should include textile chemists, color chemists, dyers, bleachers and finishers who have had five years of continuous experience in their particular line of work. They would constitute the active membership of the society. Officers and committeemen would be chosen from this group and it would in general be responsible for the activities, growth and perpetuation of the organization.

The second should include students and apprentices who definitely have it in mind to follow such pursuits as would eventually make them eligible for active membership. They should have the privilege of attending the regular meetings and receiving the publications of the organization but at a materially reduced membership fee. They should also receive the encouragement, council and advice of the active members in every way possible.

SUSTAINING OR CORPORATION MEMBERS

It would be impossible for such an organization to develop along the lines described and accomplish the greatest good if entire dependence was to be placed upon the dues of the active members. The dues for them should be placed as low as possible and their contribution toward the advancement of the work should be made in terms of service rather than money.

The following illustration will serve as one of many which might be given to indicate the utter hopelessness of attempting to develop an organization along the lines already mentioned if dependence was to be placed entirely upon active membership dues. I refer to the work of standardizing the methods of testing and recording the fastness of dyes to light. To bring such an undertaking to a successful termination would require the dyeing of thousands of samples under varying conditions and exposing them to sunlight in various latitudes and under different atmospheric conditions, also to the various types of artificial fading agencies, such as the ultra violet and electric arc lights. This would require the services of at least two painstaking and conscientious workers for several years and, together with the necessary clerical

work cost several thousand dollars a year. It would, however, when completed and properly continued in regard to new dyes, be of inestimable value to the textile manufacturer who uses any variety of colors.

MANUFACTURERS WOULD BENEFIT

As the textile and color manufacturing concerns of the country would be benefited to a great extent, both directly and indirectly, by the successful development of such an association it would not seem unreasonable to ask them to furnish the necessary financial support for its development and continuance. This might be accomplished through a sustaining or corporate membership. There should be no fixed membership dues, but it would be hoped that each would contribute in proportion to its capitalization or importance in the industry. Provision should, of course, be made for some sort of representation of these sustaining members in the society.

There are but few large corporations which are not constantly risking the expenditure of large sums of money within their walls upon ventures of various kinds in hopes that something of benefit may materialize. Why should it be unreasonable to ask them to invest, comparatively speaking, a small sum of money in a technical association that might bring more positive returns than some of their other ventures?

THREE ENCUMBRANCES TO PROGRESS

The elements which might tend to delay the development of such an organization are Secretiveness, Indifference and Selfishness.

In regard to the first: Secretiveness has always been something of a "bug-a-boo" to the development of scientific projects, but more often than otherwise it has proved to be a boomerang to those who gave it too prominent a position in their code of ethics.

For twenty-five years the author has had an excellent opportunity to study this element in industrial psychology, has been through some rather interesting experiences and has had an opportunity to observe ultimate results. It is very interesting to have a manager hustle you by the door of a room partitioned off at one end of the dye house with the statement that it contains one of their secret processes when you are already acquainted with the fact that it is a screen used to cover an attempt to develop a machine pilfered from some one else; or in another instance after cautiously closing the doors and windows confidentially and as a great favor tell you about a process he has discovered, when you have known of some one else doing the same thing three years before in a far better manner without making any secret of it whatever.

The corporation that builds a high wall about its technical staff and their discoveries and methods of procedure, if it but knew it, is at the same time building a stronger wall between itself and the information that might be obtained from the outside.

INTELLIGENT CO-OPERATION SUPPLANTING SECRETIVENESS

A reasonable amount of secretiveness in regard to one's business is quite essential at all times, but the power, or at least the willingness, to discriminate between the essential and the non-essential seems to be entirely lacking in some cases. Observation would seem to indicate that the more objectionable type of secretiveness is rapidly passing away. The younger and more scientifically trained managers of to-day are more open minded than those of twenty or even ten years ago. The writer has recently been invited to go through several plants which ten years ago were closed tight. On the whole, it works something like this: If you help a man out of a hole to-day it is human nature for him to help you out of a deeper one to-morrow.

Indifference or, more bluntly speaking, laziness on the part of the individual members, reluctance in regard to serving on committees, unwillingness to prepare a paper occasionally and to attend meetings when possible, are all hindrances—but members of this type are sooner or later swept into the background to make way for newer and more active members.

Unwillingness on the part of some of the corporations to recognize their responsibility in the development of such an organization would also prove a hindrance.

All of these briefly discussed elements might tend to delay but could not permanently interfere with the development of an organization of serious-minded men with a definite purpose in view.

In closing this discussion, mention should be made of one unfavorable view which has been expressed, namely, the multiplicity of societies and clubs and their ever-increasing dues. As one man puts it, we are literally having our salaries "clubbed" out of our pockets. We all wish that the number was less instead of more, but in this particular case there seems to be no other organization that can satisfactorily accomplish the desired purpose or introduce the features which appear to be necessary for the successful development of an American Association or Institute of Textile Chemists and Colorists. More than thirty-five years ago the British textile and color chemists came to a similar conclusion and organized their Society of Dyers and Colourists, although they already had a well-developed Chemical Society and Society of Chemical Industry.

SILK DYEING

The relatively small amount of silk required in a silk dress throws light on the amount of dye required to color it. As a rule, medium shades on silk do not require more than two or three per cent of the dye. There being 20 ounces of silk in a medium weight dress, the amount of dye used for coloring it is considerably less than one ounce, which at the average prices for silk dyes makes the dye cost not more than 25 cents.

The Bichromates and Wool Dyeing

First Paper

Little Understood Reactions Involved in Use of Chromates as Wool Mordants—the Necessity for Careful Control of Oxidizing Properties—Precautions to Be Employed in Making Wool Absorb Chromic Acid Without Injury from Nascent Oxygen

By WINTHROP C. DURFEE

Consulting and Manufacturing Chemist, Boston, Mass.

CHROMIUM was first recognized as a separate element in 1797, and apparently was first manufactured into chromates between 1840 and 1850, as the earliest mention of patents for the manufacture of chromates is of one issued in 1847. Its earlier application to the dyeing of fabrics seems to have been on cotton yarns which were dyed yellow by the fixation of chrome yellow in the fiber by the interaction of chromates with acetate of lead. This yellow has also been used in connection with vat-dyed indigo blue to produce fast greens on the cotton fabric.

LIMITATIONS OF EXISTING LITERATURE

Books published previous to 1870 give very little information on the use of chromates in dyeing, and "Slater's Manual of Colours and Dye Wares," published in 1882, speaks of bichromate as being principally used in connection with Logwood blacks, but considers such blacks as being less permanent than those dyed by the use of copperas. This is a clear indication that the use of chrome as a mordant was very little understood at that time. Slater, however, speaks of bichrome being extensively used in dyeing and in printing yellows and oranges along with various preparations of lead—an indication that at that time bichromates as mordants had not become important. Bichromate, however, presented such great advantages in wool dyeing that it rapidly became the universal mordant for fixation of lake-forming dyes on wool. Nearly all the literature that has been published in connection with wool dyeing since 1880 has assumed that the application of bichromates to wool for mordanting purposes was well understood, and has simply published the commonly accepted formulas with occasional comments on the effect the various acid assistants used in the fixation of the chrome had on the final results in dyeing. No attention seems to have been given to the reasons for these final effects; nor has any study been made as to the whys and wherefores of the application of chromates to wool, the peculiarities of the mordant bath, nor as to the character and condition of the chrome as associated with the wool when fully prepared for the dye bath or what effect this may have upon the working properties of the dye bath independent of the simple fixation of color on the fiber.

MORDANTS IN GENERAL

It may not be possible to answer all the questions that

arise when the problems indicated are considered. But we must first realize the nature of the materials with which we are dealing and consider them in relation to the object to be attained. A simple statement of the object is that it is to mordant the wool with chrome. A mordant is a substance that holds or fixes a dyestuff on the fiber by reason of some combination between the mordant and the dyestuff. In general, also, the mordant is absorbed into the fiber and there so changed by the effect of the fiber or by the assistance of other chemicals, that it is not easily removed; and in general also this mordant has a greater attraction for mordant dyestuffs than has the fiber itself. The mordant thus acts as an intermediary for both fixation and attraction. As the mordant is fixed on the fiber through the assistance of other chemicals, or some modifying effect of the fiber itself, the compound primarily used for mordanting purposes should be one which does not seriously injure the fiber, one which is absorbed by the fiber, one that, where necessary, can be changed in the fiber to a more insoluble form, and to a condition where it will combine with the dyestuff. The compound should be of such nature that this fixation and change can be absolutely controlled by the dyer and the ultimate fixation and proper condition obtained with absolute uniformity. For the fixation of so-called mordant dyestuffs, or lake-forming dyestuffs, which is the same thing, the mordant in the fiber must be a base and not an acid, since practically all of the mordant dyestuffs are organic acids and are made into the color lake or fixed by the mordant only as they form relatively insoluble compounds with metallic bases previously fixed in the fiber, that is to say, with the mordant. The mordant in its final condition must, therefore, be a base, because the dyestuffs are acids.

In former times, when dyeing was dependent upon natural dyestuffs, wool dyeing processes were largely carried on by what was known as the stuffing and saddening process; that is, the saturation first of the fiber by the dyestuff, and the aftertreatment with metallic salts, which gave up part of their metallic base to the dyestuff, forming insoluble compounds in the fiber.

AN APPARENT CHEMICAL CONTRADICTION

The salts of iron, tin, alum and copper were also used to some extent as mordants, being boiled into the wool before dyeing, generally with the aid of some organic

acid; or in more ancient practice light shades were mordanted by a long-time soakage in weak solutions of metallic salts at relatively low temperatures, and the dyeing was of a comparatively light shade on the small amount of metallic base absorbed. This dyeing was repeated in the same manner, the yarn remordanted and redyed several times until the shade was built up to the desired depth—the process being very slow and very complex, but resulting in colors of great fastness, particularly with madder and the yellow woods. This is understood to be the method of the Orientals which gives such depth and purity to the colors of their rugs.

The important thing to realize is that the mordant that fixes mordant colors on wool usually is a metal in the basic form. A first glance at the nature of bichromate of potash would show that it is primarily unfitted to act as a mordant for the reasons that it is an acid salt of chromic acid, that the chrome is present as chromic acid and that the only base present is potash. We know that potash and soda both form compounds that are too soluble for any fixation purposes and that the chromic acid is not a base. On the face of things there is nothing in bichromate of potash or soda to fix the dye, but experience shows us that it is eminently adapted for such purposes. A moment's reflection will show that a great many changes must take place somewhere along the chain of operations to make the fixation of dyestuffs by chrome in the basic form possible with a compound which contains no basic chrome. A following out of these changes will explain the apparent contradiction and possibly give some guide for the future as to methods which will produce the best results.

ACID CHARACTER OF THE CHROMATES AS A FACTOR IN WOOL MORDANTING

The nature of bichromate of potash or soda, as already stated, would seem to prohibit its satisfactory use as a mordant, because the chrome is there in the condition of an acid. It is, however, this very fact that makes its application to the wool fiber as a mordant easy, and the ultimate results highly advantageous above the use of the metallic salts such as the alums. The wool fiber has an intense affinity for acids, which is greater at high temperature. Most acids seem to be absorbed throughout the fiber and without material change in their nature, or in other words they easily distribute themselves through all parts of the fiber, giving penetration and evenness. Conversely it is this attraction for acids that makes it difficult to fix the metallic elements of the alums and copperas in the fiber, because the wool fiber has a tendency to absorb the acid radicals from solutions of alum or copperas, leaving the metallic element in a much less soluble form, so that it has a tendency to precipitate upon the surface as a scum without any true absorption. This tendency of precipitating alum or iron on the fiber can only be controlled by the use of large quantities of organic acids which maintain the solubility of the metallic base, and allow a reasonable amount of it to be absorbed

making the mordanting process difficult. This was very important in the early days. Chromic acid being absorbed by the fiber very readily without other assistants, gave excellent results with unoxidized logwood.

RESULT, NOT REACTION, WAS EARLY CONCERN

The early use of bichromates with unoxidized logwood was an extraordinarily fortunate accident, as the oxidizing power of the bichromate actually developed the coloring matter in the logwood, and the logwood reciprocally altered the chromic acid of the bichromate into basic form suitable for combining with the dye, and this possibly explains why in the early days of the use of chrome very little attention was given to its real nature. It worked satisfactorily and that was quite sufficient. The first alizarines also that came on the market (Alizarine Reds) were not easily affected by the powerful oxidizing action of the chrome. It was only after bichrome became very firmly established that the question was raised as to whether there were not better methods of its fixation, and whether better and finer results could not be obtained by using some modifying assistant in the mordanting process. Dyers naturally turned to the organic acids which had been necessary in an earlier day in the fixation of salts of alum, iron and tin; and the results obtained in some instances were highly advantageous. But what actually took place was little understood. The dyers were conscious that the chromic acid was somewhat altered by the organic acids used, and were told by chemists that the chrome had been reduced. It was very common at this date to confuse this word "reduction" with "fixation," and further with the idea of a quantitative increase of the chrome absorbed by the fiber, often spoken of as increased reduction, so that one often heard the expression that the bichrome had been reduced by the oil of vitriol, which actually meant that the oil of vitriol had neutralized the potash and liberated a larger portion of chromic acid to be absorbed by the wool as chromic acid. This was further confused by the fact that the wool, due to its sulphur content, actually did deoxidize the chromic acid to some extent, though noticeably to the injury of the wool fiber.

CAREFUL CONTROL ESSENTIAL

While remembering that bichromates are the best material at present available for mordanting, it might be well to note the unfitness of chromates as such for use on the wool fiber or in combination with organic dyestuffs where careful control of its power as an oxidizing agent is not exercised.

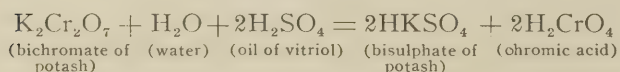
It has already been stated that the acid character of chromates is of great advantage on account of their ability to penetrate the fiber as acids and distribute themselves evenly. We also pointed out that products to combine with the dyestuff must not be an acid but must be a base. The difference between compounds of the metal chromium in chromic acid and the metal chromium

as a base in chrome alum, or chrome fluoride, or in the form in which it will unite with mordant dyestuffs, is in the amount of oxygen chemically combined with the chromium. In chromic acid and chromates the chromium is united chemically with twice as much oxygen as it can combine with when in the form of a base, and it is the removal of this oxygen from the chromic acid absorbed into the fiber, or as it is absorbed into the fiber, or in some part of the process of mordanting—at what point it is difficult to say—that is necessary to bring about a change to the form where it can fix the dyestuff.

Now, when chromic acid gives up its oxygen the oxygen is in such an active form that it has intense affinity for other materials, which amounts to a destructive action ordinarily called oxidation, and is similar to the destructive action of hypochlorite of lime (bleaching powder), nitric acid, the permanganates, peroxide of sodium or hydrogen and the chlorates. As illustrations of this, chromic acid was formerly used for bleaching oils and fats, it is used in surgical practice to-day for the destruction of diseased tissue, and for a disinfectant to some extent. The activity, however, of chromium in bichromate of potash or soda in giving up its oxygen is very largely controlled; first, by its concentration on or with material which can be destroyed, second by heat, third, by the presence of strong acids which increase its activity by neutralizing the soda or potash. The presence of strong alkalies retards this activity. Bichromate of potash or soda may be considered a substance in which the chromic acid is half neutralized, and one in which the tendency of the chromic acid of the chromate to give up its oxygen is relatively weak, due to the fact that this half neutral relationship holds the apparently free acid half with considerable force. When very strong acids are used in connection with the bichromate, that is, acids that might be considered physically stronger than the chromic acid itself, chromic acid is liberated in a very free and active state, and under these conditions will oxidize sulphur from the wool fiber producing sulphates. As this sulphur is chemically a part of the wool the elasticity and the strength and general physical character of the wool is very much impaired by its removal.

ACID CHARACTER OF CHROMIC ACID IN $K_2Cr_2O_7$

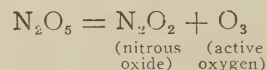
The conveying of the chromium to the fiber in the form of a strong acid having a powerful oxidizing or chemical action on everything it touches must be thoroughly controlled in order to protect the fiber. This is more important where the dyestuff to follow is one of the highly complex coal-tar derivatives. The acid character of chromic acid in bichromate of potash may be very clearly expressed by the following formula:



The acid character of this chromic acid is here very graphically shown because its formula is like that of the

oil of vitriol when substituting for the "S" (symbol for sulphur) in formula for oil of vitriol (H_2SO_4) and "Cr" (symbol for chromium) we have the symbol for chromic acid H_2CrO_4 . This chromic acid, unlike oil of vitriol, is an intensely active oxidizing chemical tending to throw off some of its oxygen on the slightest provocation, thus, $2H_2CrO_4 = 2H_2O + Cr_2O_3 + O_3$. This property is shared by permanganate of potash, potassium chlorate, the peroxides and nitric acid.

The symbol for nitric acid is HNO_3 . Multiplying this by 2 we have $H_2N_2O_6$, which equals $H_2O + N_2O_5$. This N_2O_5 has the same strong tendency to give up its oxygen as chrome acid has, and we have



This is one reason for the action of compounds of nitric acid in explosives. It will be noted that in these reactions both the chromic acid and the nitric acid separate off their oxygen actively as a triplet. Under some circumstances O_3 is called ozone, an extremely active form of oxygen, although there is no proof that the detached oxygen here under consideration is in the form of ozone.

The chemical action of the bichromates is so strong and destructive that during the war they were classed among the chemicals whose possession was prohibited except under "explosive licenses" issued by the Government. For, though innocent in themselves, they could be used with dangerous results if in the hands of maliciously disposed persons.

NASCENT OXYGEN DESTROYS WOOL FIBER

The action of nitric acid on the wool fiber is well understood and known to be very destructive, and also its action on the coloring matter of indigo in the well-known nitric acid test for indigo dye. We have here action on the fiber and the dye caused by the destroying power of the oxygen, which, in a differing form, is identical with that of air in burning wood. When bichromate of potash or soda is used as a mordant on wool, the solution of chrome in the mordant bath is so weak that there is practically no danger of these destructive actions taking place, but where there is an acid condition present and the sodium or potash base of the bichromate is neutralized, the active chromic acid is set free, and as there is an intense affinity between wool substance and chromic acid, this acid is rapidly absorbed into the fiber, a fact familiar to every dyer. Where there is forty times as much water as wool in the bath, 3 per cent of chrome to the weight of the wool would be in a dilution with about 3 to 4,000—that is, 1 part in 1,300. But if this chromic acid is all absorbed into the fiber it will be concentrated into 3 to 100 or 1 part to 33. This is a fairly concentrated form for so energetic a chemical, and especially as this absorption generally takes place at a boiling temperature which radically increases its activity.

If this chromic acid remains unaltered or not materially altered in the wool when the wool is passed into

the dye bath, and the action of dyeing concentrates the dyestuff into the wool fiber, finally an intimate mixture of a fairly strong solution of chromic acids with the dyestuff takes place in or on the fiber, and at the boiling temperature before spoken of. One has only to take a solution containing 3 per cent of its own weight of bichromate of soda and 1 or 2 per cent sulphuric acid, and boil 1 to 10 per cent of any dyestuff, excepting Alizarine Red, in it, to discover in some degree the destructive action of chromic acid.

The problem of mordanting wools, then, consists in making wool absorb chromic acid in such a manner, and associated with such substances, that the wool fiber will not be injured. And, in passing, it may be here said that reworked wool, wool extract, or shoddy, is far more sensitive to serious injury from oxidation than new wool. Owing to the previous treatments old stock has encountered; and second, chromic acid must pass through a series of controlled changes that fit it to combine with the dyestuff without altering the character or composition of the dyestuff (excepting unoxidized logwood and a very few coal-tar colors that require an oxidation development.)

FACTORS GOVERNING CONTROL

A further example of the destructive action of the oxygen in chrome is one that is very familiar, that is, the stripping of color from woolen rags. Ordinarily, in mordanting, 3 per cent of bichromate of potash or soda is used with, sometimes, 1 per cent oil of vitriol, or 1 or 2 per cent of oxalic acid—though more often milder acids or acid compounds are used. For stripping the color from rags and destroying the original dye, about 5 per cent of bichromate of potash or soda is used, together with sufficient sulphuric or oxalic acid. Here we have approximately 3 per cent of chrome used as a mor-

dant intended to fix a color, and in the other case, 5 per cent used as a stripping agent to destroy color. It is very obvious that where the chrome is used as a mordant, unless properly controlled and changed, it will have some radical effect on the same dyestuffs that it so completely destroys when used as a stripping agent. The problem therefore finally resolves itself into the statement that the chromic acid or bichromate of potash must be absorbed into the wool as an acid; that it must be associated with materials more easily oxidized than any oxidizable material that may be in the wool; that it should be so altered during the process of mordanting that it will, first, not give up any oxygen harmful to the dyestuff, and second, that the chrome shall have been altered from the acid to the basic form. In addition to all this there should be no chrome either in the acid or the basic form so loosely fixed or attached to the surface of the fibers that it can disengage itself or be redissolved into the dye bath. In this last case a reasonable amount of loose color lake will be formed involving loss of dyestuff, and the formation of crock, which is color lake held on the surface of the fiber, very difficult to completely remove by any process that can be applied in the mill.

The question of the control and fixation of chrome upon wool for mordanting purposes is very complex. It varies with the percentage of chrome necessarily used and with the nature of the dyestuff which is to be used; and the demand for clearness or brilliancy in the color produced; and of certain conditions such as special fastness to light and washing which may be demanded.

These subjects will be taken up in a later paper, first, from purely theoretical standpoints, and second from the standpoints of methods best applicable to mill practice.

Correct Water for Dyeing and Textile Purposes

Historical Outline of Water Purification—Various Types of Filters—Chemical Aids to Filtration—Removal of Iron and Manganese Salts—Water Softening—Zeolite Softeners

By A. T. SMITH

THE history of the textile industry designates that the fundamental appreciation of the value of correct water supplies was had by forerunners of the textile industry. This is clearly evidenced in modern times by the location of silk mills in the Lyons River Valley in France, the location of woolen and worsted mills in the Bradford district, England, by American textile manufacturers settling in New England, northern New Jersey, Philadelphia and the South. In all of these districts the waters approached, as far as nature provides, the ideal condition virtually demanded by the men who thoroughly appreciate textile needs.

Science has proved that the ideal water for textile purposes should approach, as nearly as possible, distilled water—i. e., pure H_2O —which means that water containing turbidity and color (organic and other matter in suspension and solution), salts of iron and manganese, salts of calcium and magnesium (hardness), and other impurities such as considerable quantities of chlorides, objectionable odors, etc., is not only undesirable, but militates against successful mill operation and the processing of all types of yarn and fabrics.

The increasing intensity of population in the districts referred to, which necessarily accompanied the successful

operation of the mills, aggravated the water troubles and speedily designated that the erstwhile satisfactory water supplies had to be artificially rendered pure, or satisfactory.

In the past in England and in France water supplies containing objectionable amounts of iron and manganese, calcium and magnesium salts were improved by the old Clark process and modifications of the same, whereby lime, soda ash, and the equivalent thereof, were administered to the water. This process is the forerunner of all types of modern chemical water softeners, generally referred to as lime-soda ash water softeners.

Filtering water through various filter mediums had preceded the initial development of the Clark process. Thus in the early stages of the modern textile industry vigorous attempts were made to obtain a correct water supply.

The present demand in the arts for correct water supplies focused the attention of many scientists on the solution of this problem, with the result that in the last decade or two water softeners of many types have been developed to what is probably their greatest efficiency under the limitations of their design and fabrication.

The defects and advantages of various types of water treating apparatus are possibly well known to the operators of dyeing establishments and textile mills. Therefore it may be that the listing herewith of these processes fails to present new information. However, segregating the entire field may inject an element of interest.

FILTRATION

Organic and inorganic matter in suspension and in solution (turbidity and color) are principally removed mechanically by filtering, sometimes assisted by the use of chemicals. The type of filter usually employed in the textile industry is the steel pressure filter, consisting of pressure vessels filled with a graded bed of filter material, generally consisting of pure quartz sand and gravel, sometimes consisting of charcoal, coke, marble, etc., which overlays a collecting or strainer system so located as to assure even draw-off of the filtered water and to permit of proper lifting and washing of the filtering medium to cleanse it of the collected filtrate and to properly dispose of the filter bed in its container. These filters are eminently successful when their rate of filtration is selected to accord with existing local conditions, and when chemical assistance is rendered, when required.

Some important textile establishments are equipped with wood tub gravity filters, or concrete gravity filters, generally called rapid sand mechanical filters, which are representative of the pressure filter described above with the exception that the shells or containers are not closed in, and the apparatus does not work under an appreciable pressure head.

The success of the filter in its duty of cleansing the water, entirely depends on its happy co-ordination with the local water distributing system, on the quality of water to be filtered, on the quality of filtered effluent desired, and on the use to which the filtered water is to

be put. "Any old filter" will not do, and the condemnation of many filters that have failed to function is unwittingly based on the fact that improper selection was made and that fundamental appreciation of these principles was not taken into consideration when the filter was installed; it cannot be denied that the unhappy practice of buying "just a filter" has caused many a mill operator large sums of money in spoiled output.

When the impurities in the water to be filtered out do not subscribe to "straight filtration," or filtration without the use of chemicals, then generally a coagulant is applied which, combining with the alkalinity either present in the water or artificially produced, forms the well-known "flock" which, adhering to the filtering medium, assists the filter bed in performing its duty. The coagulant must be carefully selected and, in accordance with the quality of the filtered water, it must be given sufficient time to react thoroughly. Common practice in the treatment of many waters is to add the coagulant to the inlet of a settling basin, which, being properly baffled, provides the requisite detention period of generally two hours to four hours, and in which a considerable portion of the impurities settles out, thus relieving the filter of that much of the duty of clearing up the water.

The coagulants generally employed are sulphate of alumina and ferrous sulphate. If, after their reactions, objectionable gases or minerals are left in the water, they can be easily removed or neutralized by the addition of another soluble and unobjectionable chemical. The coagulant, and subsequent chemical, if used, must be carefully and proportionately fed to the water, which is easily done by employing modern apparatus manufactured for this purpose.

The effluent of every filter plant can be neutral water and water which is sparkling, bright and clear. It frequently happens that filters are purchased for purposes which are beyond their ability to satisfy. Thus it must be appreciated that if water is not clear, it does not necessarily follow that even its correct filtration will clear it up; consequently scientific examination of water supplies should be made before filtration or other apparatus is purchased.

REMOVAL OF IRON AND MANGANESE SALTS

The unfortunate influence of iron and manganese salts on textile yarns and fabrics is too well known to be touched upon here. These salts exist in both lower and higher forms in water supplies. Sometimes they can be removed by ordinary filtration, but not often. Generally other steps must be resorted to, all of which embrace the oxidation of the salts in question to a higher form, under which they precipitate out and can be removed by either specially designed, or ordinary, filters. This oxidation is effected generally in one of three ways—oxidation of the water by the addition of an alkali which, neutralizing the CO_2 permits the oxygen dissolved in the water to oxidize the salts; oxidation effected by specially prepared zeolites.

The effluent of these iron and manganese removal

plants should be water, bright and clear, and which remains so on standing exposed to air for twenty-four hours. In such state the water will not react with dyestuffs or bleaching chemicals.

The solution of these tricky problems is not simple. Rule of thumb methods should not be applied, because in accordance with the amount and nature of the iron and manganese salts contained in the water specially prescribed apparatus should be applied, having in mind not only the elimination of objectionable constituents but so treating the water that later on it will give no trouble. This, again, is a problem that requires scientific solution. The market affords apparatus built by manufacturers equipped with a staff of technical men which can successfully deliver the desired results.

WATER SOFTENING

Softening is the treatment of water for the reduction of and transformation of salts of calcium and magnesium to a non-encrustating salts such as those of sodium. Distilling apparatus in a certain sense is water softening apparatus, in that distillation of water discards objectionable salts. Unfortunately its purchase price and maintenance charges remove it as a pure water producer for textile mill water supplies.

Chemical softeners consisting of continuous and intermittent cold process lime-soda softeners, continuous hot process lime-soda softeners, continuous and intermittent cold process lime-barium softeners, and infrequently softeners using reagents other than lime, soda ash, and barium salts, are on the market. In the past they have been in more or less general use.

The apparatus most commonly used was the continuous and intermittent cold process lime-soda softener, wherein water in its natural state had proportionately added to it solutions of lime and soda ash, which effected the reduction of iron and manganese salts, the reduction of carbonates of calcium and magnesium and which translated chlorides and sulphates of calcium and magnesium into equivalent salts of sodium. The reagents of whatever type used in chemical softeners consisted of alkalies, and since it was necessary to use an excess of such reagents to drive and maintain the chemical reactions, invariably the effluent of such machines was caustic and therefore presented a problem later on to dyers and men in charge of other textile processes.

The reagents of whatever kind had their limitations, and experience proved that, on the average, the hardness of the water was reduced to a matter of five to six grains per gallon, and that alkalinity or phenolphthalein alkalinity was put in the water as well as causticity. Experience also proved, since most water supplies varied in their chemical composition and since the reagents themselves varied somewhat, and because of the human factor injected into the operation of such machines, that their effluent was variable both as to hardness constituents and constituents of soluble salts. Consequently dyers

and others when using such water were denied the opportunity of working on a stabilized water supply, which is essentially desirable.

These machines consisted, essentially, of a proportioning chemical dosing mechanism; of a settling tank wherein chemical reactions took place, and the resultant precipitate which would not settle out. Their operating success depended on the correctness of design and fabrication, the skill of the operator in selecting and administering the correct chemical dosage in accordance with the chemical composition of the water, the effectiveness of filtration, and the subsequent ability of dyers and others to adjust the treated water to their needs.

It is an old story that dyestuff radicals were reacted by this chemically treated water unless great skill was exercised in preparing the various baths. In addition to this, the water contained appreciable amounts of calcium and magnesium as well which, in following articles, will be shown to be deleterious to textile work.

The continuous hot process lime-soda softener was rarely applied for the preparation of textile water supplies, since in the course of treatment the water was first heated to 200 deg. Fahr. or more. Such machines were principally used in the textile mills for the boiler plants only. This machine, because of the assistance rendered by heat in maintaining and driving the chemical reactions, delivered an effluent containing less hardness than that contained in the cold process treated water. However, the effluent still contained alkalinity and causticity.

The lime-barium softener is applied to high sulphate waters only, since barium salts react with sulphates and precipitate them. Barium salts are expensive, thus the cost of treatment is high and rarely do we find these softeners used in textile mills, although some of them are used in certain parts of the country for the preparation of boiler feed waters.

ZEOLITE SOFTENERS

Zeolite softeners were developed along lines imitating nature and function on an exchange principle under which calcium and magnesium bases are interchanged for a sodium base, by bringing the water in contact with a zeolitic material housed in an open or closed vessel. The water is thereby softened without the addition of any chemical.

The zeolitic material is prepared with a sodium base which has a greater affinity for the radicals of calcium and magnesium salts than has their calcium and magnesium base. The exchange of sodium for the calcium and magnesium in the water is automatic and instantaneous. When the zeolitic material is exhausted of its sodium, the softener is regenerated by drenching the zeolitic material with a brine of common salt—i. e., sodium chloride—of sufficient strength to maintain a chemical mass action, which results in the reconditioning of the zeolitic material in the form of restoring to it a sodium base. The resulting brine is a clear solution, consisting of a mixture

of calcium, magnesium and sodium chlorides. This brine is conveniently run off to sewers and thus eliminates sludge disposal, incidental to the operation of chemical water softeners.

Since chemical reactions are not employed in the zeolitic process, a complete reduction of calcium and magnesium is had, and over or under treatment is impossible. Consequently the treated water supply is stabilized, it is uniform, and is ideal for all textile purposes. The effluent of a correctly designed and manufactured zeolite softening plant is a clear, iron and manganese free, neutral, water, containing no hardness, referred to in the trade as water of "zero" hardness. The sodium salts contained in this water are entirely unobjectionable; the water is a splendid vehicle for dyes, it is perfect for bleaching, scouring, finishing, mercerizing, scouring, boiling off and degumming, weighting, etc.

The zeolite softener requires no attention while in operation, and no skilled attention of any kind is needed during the regeneration, since the amount of salt administered is always the same, and because apparatus provided by the makers of such machines enables ordinary unskilled labor to correctly regenerate them in a short time.

The zeolite softener is the most modern development of the water softening art. It is economical in maintenance charges, in floor space requirements, and it assures perfect results for all textile needs.

During the last ten years textile mills have clearly designated their appreciation of these facts since, with very few exceptions, zeolite softeners only have been purchased. The resultant economy of mill operation and improvement in the quality of yarns and fabrics distinctly bear out the claims made for such equipment—that it is the one practical device on the market to-day which completely and economically solves the problem of the textile manufacturer.

Mill water supplies that contain what was supposed in the past to be unobjectionable amounts of minerals have been treated by zeolite softeners to the great benefit of the mills and to the astonishment of technical bodies which took these issues into consideration.

Therefore the march of progress clearly indicates the desirability, and possibly the necessity, of removing the last traces of organic and inorganic matter from textile mill water supplies. Since only a stabilized pure water can be freely used without deleterious effect later on in the mill, and without impairing the quality of the mill output, and since in no practical way can this supply be obtained except the water be carefully and correctly treated by employing apparatus which under close inspection clearly proves its ability to do the expected work, it is recommended to the textile mills to look into these matters more than "casually" and thus give their processing departments a chance to produce economically the desired grade of output of the mill.

HISTORICAL SKETCH AND OBSERVATIONS ON DEVELOPMENT OF FRANKLIN DYEING

By W. W. WEEDEN

With Lockwood, Greene & Co., Engineers

SOON after the introduction of vat colors into this country it was seen that there was need for a better and more economical method of applying these dyes to yarn than the methods then in use. Several European manufacturers were making what they called "cheese dyeing machines," but this method has never been a complete success for several reasons. They dye a parallel tube of yarn which is wound on to a small perforated metal tube, using for the winding a split drum winder. This makes a package which is concave rather than straight, and being hard at each end it has never been possible to obtain even dyeings with these drum-wound cheeses. The metal tube did not allow the packages to come in contact with each other at the ends closely while being dyed through. All of these dyeing machines were made with open kiers so that with vat colors considerable oxidization of the dye liquor resulted; and in open kiers, without any sort of a vacuum, they were unable to obtain thorough circulation.

Having in mind, however, the immense advantages of this system of dyeing, once its difficulties could be overcome, Mr. Daniels, at the time agent of the Franklin Mills in New Hampshire, invented and patented the Franklin Tube, which is made of a helical spring, compressible in the direction of its length, covered by a knit cover, and on which the yarn to be dyed is wound. The idea of a compressible tube was new and a basic patent was obtained covering this invention. With a proper tube on which to wind the yarn, the next problem was to find a winder which would wind an absolutely uniform package and without the hard ends of the drum-wound package. After numerous experiments with various winders, the company interested the Universal Winding Company in the proposition, and it was seen at once that their parallel tube winder would give exactly the results desired. An adjustable holder was designed to hold the Franklin tube on the spindle, and this solved the winding problem.

The principle of the Franklin process is extremely simple. There is a round tub or vat of suitable material for the particular fiber to be dyed, in which are a varying number of upright perforated tubes on which the packages are pressed down and through which the dye in solution is first forced by a pump from the inside, out, and then back from the outside, in. This change in direction of the flow of the liquor is accomplished by an ingenious four-way valve, shifted by one turn of a straight iron bar. The temperature and pressure are always under perfect control by means of valves, with a thermometer and gauges in plain sight.

While the principle involved in the dyeing has remained unchanged, it must be admitted that the first machines were very crude and resemble the modern ones about as much as the first horseless carriages resemble the latest limousines. Yet, the fact that mills readily tried out this new process is proof positive that there was a big demand for this type of machine. It soon became apparent that the Franklin process would be useful for classes of work other than the vat colors, and soon direct and sulphur colors were dyed by this method. For a long time it was not considered possible to dye the basic colors in these machines, but this has now been accomplished, and to-day an immense amount of this work is done; good results have also been obtained with the developed colors.

Experiments were carried out with worsted and woolen yarns, and the results obtained were every bit as good as on the cotton. It was found that fine single woolen yarns, and the results obtained were every bit any difficulty and with no trace of felting whatsoever. Silk noil yarns are now also readily handled. When the war broke out there was a tremendous demand for worsted top dyeing, which resulted in the bringing out of the Franklin Top Dyeing Machine. This machine is constructed on the same lines as the yarn dyeing machines and handles tops which are wound on a Franklin tube similar to the yarn tube, but much larger. This machine was an instant success, and has given splendid results wherever it has been installed.

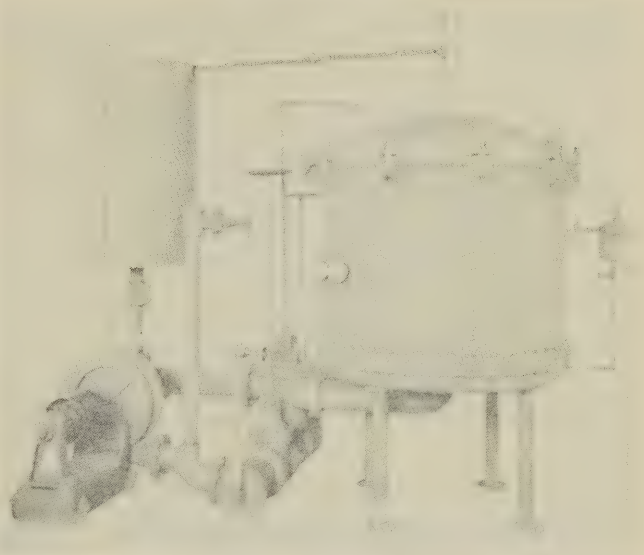
About this same time a jacks pool dyeing machine was developed for dyeing worsted or wool yarns on jack or dresser spools, thus eliminating the expensive and wasteful skein dyeing and winding. These machines, like the others, have proved to be one of the greatest money-saving devices ever used in a mill, and in three years' time have been placed in many of the fancy worsted mills in the country.

More recently the process has been applied to carpet yarns with equal success, and even a greater economy and convenience, since the elimination of skein winding is the greatest possible boon to a carpet mill. Skein dyeing always produces some uneven dyeing—usually a considerable amount. If the Franklin machine is handled properly, there is seldom any uneven dyeing, the only stipulation being that the yarn shall be reasonably clean and the dyes used readily soluble.

In cotton dyeing with the Franklin machine there is a marked saving in dyestuff. In both cotton and wool dyeing there is a saving of about 50 per cent in both labor and floor space. The labor need not be skilled labor, either, which is a great convenience over skein dyeing, where it takes some time for the operator to learn to handle skeins. A man can learn to handle the Franklin machine in a few hours.

By twisting the silk yarn with cotton yarn as a "leader," very fine artificial silk can be dyed; the "leader" being separated after dyeing and used over and over again.

In order to demonstrate these processes of dyeing



All Iron Franklin Dyeing Machine

it was necessary to start a small job dyehouse in Providence, where sample lots could be dyed for prospective customers. This end of the business has grown until in the first six months of 1920 the Providence plant dyed over 1,000,000 pounds of cotton and worsted yarns, and the new plant in Philadelphia produced about as much more.

The small dyehouse in Providence being inadequate to handle properly the above-mentioned amount of yarn, a set of buildings was purchased, which were suitable for a machine shop and receiving, shipping and winding. The only new building needed was the dyehouse. In designing this new construction, Lockwood, Greene & Co., engineers, of Boston, were consulted. By working together, a plan was agreed upon in which every problem of handling yarn and dyeing by the Franklin process was thoroughly studied and finally solved, resulting in a most complete, economical, and modern dyehouse.

In 1921 both the Providence and Philadelphia plants are running far ahead of the above figures, and another dyehouse is about to be erected in Greenville, S. C., also under the direct supervision of Lockwood, Greene & Co., engineers.

One of the features of the Franklin process is the small amount of steam required for operating the machines. The new Providence dyehouse has a capacity of 40,000 pounds of yarn a day, which means 12,000,000 pounds per year, and yet it requires for its ordinary operation only one 200 horse-power boiler; two such boilers, however, were installed for emergency, and to assure the complete and rapid drying of the packages and jacks pools. The new building has a basement about eight feet high, and the machines are arranged on a raised platform around the outside wall. This arrangement gives easy access to the machines for

(Concluded on page 33.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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CHEMICAL VS. "PRACTICAL" CONTROL OF DYEHOUSE OPERATIONS

NO less an authority than C. M. Whittaker has more than once pointed out the fact that with the growth in popularity of the coal-tar dyestuffs, and the attendant simplification of dyeing processes, the demands upon the chemical knowledge of the superintendent of dyeing, or dye foreman, have greatly increased. Originally this important factor in textile mill production did not really need a thorough knowledge of the chemistry involved in his work—or rather the need for such knowledge was not generally recognized. Now, however, the situation is reversed, and the importance of careful chemical control of dyeing processes is patent to all. In view of this, it is a matter for wonder that some of the most important mills in the country have not as yet added trained chemists to their staffs.

Viewed strictly as a matter of dollars and cents, there is nothing which can be said for an adherence to "the old way" of doing things. It will be argued by some that the experienced "practical" dyer can and does obtain good results—which is a fact. But it is also a fact that there are few things he can do which an equally experienced chemist cannot do better. Or if the results of the practical man happen to be perfect in a few instances, it has been found that the chemist can achieve them more quickly, or more cheaply, or with less waste. In even the best regulated dyehouse under the control of a practical dyer, the opportunities for improvement to results in the finished goods, or for increasing the profits by cheapening the dyeing operations, are plentiful indeed.

It is believed to be a truism to say that "the chemist is coming into his own." And a truism it is; but we must not forget that he is "coming" and that he

has not yet arrived. Prompted by an enthusiasm borne of the gains already made, it is easy to persuade oneself that appreciation of the chemists's usefulness is to-day universal. The chemist himself knows better, but he also knows that when this happy state is actually arrived at, all industries will be gainers. The task on hand is to impart this knowledge to mill owners.

In many cases it is mere inertia or a false idea of economy which prevents the mill owners from placing their dyehouses under expert chemical control. Such refusal to interpret the signs of the times is not economy, but extravagance. Foreign competitors, quicker to recognize the latter consideration, perhaps, than some Americans, are gladly paying the salaries of first-class chemists for this very reason, and their wisdom is proved by the fact that a first-class chemist can save many times his salary for the mill which employs him.

Competition will bring about the inevitable sooner or later. In the meantime The REPORTER believes that a word to the wise is sufficient, and that it has been of real service to any mill owner persuaded by these lines to investigate the benefits of chemical control in the dyehouse.

SWISS DYE INTERESTS AND THE LIMITED EMBARGO

THE position of The REPORTER with regard to the question of protecting the American dye industry has been fully known to its readers since long before a dye measure of any description ever made its appearance in Congress. There has never been the slightest shadow of doubt as to just where we stand as to both necessity and means of saving this essential factor of our industrial and military worlds from the certain attempts of the German dye monopoly to overthrow it.

But we desire first and foremost to be fair, and since there is a phase of the discussion which has been almost wholly neglected in the past, but which amply merits consideration, we take pleasure in publishing herewith a statement from a spokesman qualified to bring it to public attention. This phase of the discussion concerns the Swiss dyemakers, and E. Wallace Pierce, chemist for the Sandoz Chemical Works, Inc., representatives of extensive Swiss color interests, has furnished the subjoined presentation of their views.

We believe the contention of the Swiss color makers to be just, and feel that it is greatly to be deplored that no form of exclusion legislation can possibly be framed which can discriminate between our really dangerous competitors in the important colors, the Germans, and our friendly business rivals such as Switzerland, England and France. It is true that the Swiss manufacturers stepped opportunely into the breach after the war made it no longer possible to import from Germany, and it is true that the trade rivalry of England and France will never be the serious,

deadly, cut-throat affair which Germany will make it—and, moreover, no one denies that there is no good reason for refusing to buy German products whenever we desire to do so, as a general rule. The only unfortunate part of it is that these generalities do not apply in the case of the dye industry.

We cannot agree with Mr. Pierce that a simple tariff will avail against Germany's combined efforts to seize anew our color markets and control them. This is perfectly obvious on the face of it for the reason that the Sherman law will not permit American manufacturers to oppose Germany's methods with like methods. Had America only individual manufacturers to compete with, she could perhaps enter upon a contest to-day, but it is no exaggeration to say that because of the character of the German combine and its limitless subsidies from the German Government, America's individual manufacturers would be obliged to fight against the industrial and financial resources of all Germany.

Nor can we agree that America is unwilling to enter upon a fair contest. All that has been asked is that she may have a brief period in which to do her training. There is no desire to "smash Germany" and no desire to bring about a general and permanent boycott of German dyes. The question, as the writer says, is one of promoting a fair contest, which is utterly impossible under present conditions.

We feel bound to reaffirm our faith in the fairness and efficacy of a limited embargo law for a limited period, and at the same time take this opportunity of pointing out that the Swiss color makers need not suffer seriously thereby if they will further take advantage of their opportunities to acquire or build dye plants in this country. England and France already possess far more drastic embargoes than any proposed here.

We present Mr. Pierce's communication herewith:

The deadlock on the tariff question seems to be due, in great measure, to the fact that there is little inclination on the part of either of the contestants to concede a point or to earnestly attempt to reach a compromise for the benefit of the country at large.

Possibly the smaller American dye manufacturers believe that their rights are being championed by their larger brothers, and feel that when everything is settled, and all foreign competition excluded by a drastic embargo, they will be allowed to develop and prosper under the beneficent eyes of their protectors. Possibly they will realize their hopes, but that is not a matter to be decided here.

It is unfortunate that so little attention has been called to the fact that during the most serious dye shortage of the war the mills of this country were so largely dependent on Swiss dyes. There was a little talk during that period, but this was supplemented by the rumor that the Swiss dyes were made of German intermediates. Contrary to this statement, records

are in existence showing that the Swiss manufacturers, by their patronage, enabled many of the American makers of intermediates to find an outlet for their products and develop their plants, while waiting for the American dye manufacturers to gain headway with the simpler colors. It is manifestly unjust to Switzerland, England, France, or whoever else makes dyestuffs, to place them in the same category as Germany. America can hardly take the position that because we were at war with Germany we must never use her products. To be consistent we should exclude all the products and not seek to derive any benefit whatever from her industries or attainments. Can it be that we fear competition so greatly that we dare not enter a contest for fear of a foul or for fear of being outmatched.

Our great development in this country during the war, in matters scientific, has shown our capabilities and it is hardly the American spirit to avoid a conflict for fear of the result. It is certainly not the spirit of the American scientist, but it is undoubtedly the spirit of the high financier to use strategy to prevent a fair contest. This may be countenanced by the country when only the contestants are affected, but when the people as a whole are to be made to contribute to the earnings of the winner and when the innocent bystander is debarred from all competition it creates a situation which is distasteful to our people, who believe in fair play.

The consumer and the foreign interests other than Germany have had no champion in this contest, with the exception of the members of Congress who would not countenance national favoritism.

A consistent tariff protectionist reasons that the amount of any tariff should be adjusted so that any advantages of low labor costs or natural resources may be properly handicapped and the country expects that its legislators shall act with all the fairness of judges or referees at any sporting event. Should any champion athlete visit this country and not be treated with fairness in the matter of handicaps, the press, from coast to coast, would howl for weeks at the injustice. At the same time the big business of our country may demand that any possible competitors shall be handicapped far beyond the point of fairness and then tied, bound and shackled so there will be no possibility of even making a point.

It makes little difference to our welfare if we may be vanquished or if we win in an athletic event; we regard only the stimulus and the incentive to make a better record. In the same way competition with an efficient business rival increases quality and production and lowers prices.

At present there is no such thing as a dye monopoly in America, as some of the newspapers have claimed, but when, as in Aesop's fable, the frogs have elected the stork their king and obtained special privileges for their swamp, they must not be surprised if at a

later date there are no frogs at all—only a fine fat stork in the foreground.

Much has been written regarding the importance of the chemical and dye industry as a line of first defense in the next war. In fact, I have contributed some of that very same propaganda and therefore dare not deny the truthfulness of it. It may be added, however, that our present equipment is now entirely adequate for such a purpose. The sulphur black plants, producers of chlorine, aniline oil, methyl alcohol, nitric acid and a great number of the simpler products, are not in the slightest danger from German competition with the higher class of dyestuffs. A tariff, ad valorem and specific, can easily take care of our present industry and preserve it for use in the next war. Would the makers of plaster and concrete statuary be able to have the works of art done in Carrara marble excluded because they menaced their industry? They would be ridiculed, of course, and it is only on account of the general ignorance of the situation that we can be scared by the German bugaboo.

Our pride in our scientific attainments should make us ashamed to require more than a fair handicap. I have personal knowledge that before the war it was possible to compete with simple German dyes by having only a 30 per cent ad valorem duty which was supposed to compensate for the lower wages of German labor. There is little doubt that Germany in the near future will pay much more for labor, so that with a higher tariff our chances of competition should be quite favorable. Our savings will come in the line of increased yields and efficiency which will rise gradually as practical common sense is allowed to filter in and modify the purely academic features.

It can be done. we can have a tariff bill that will protect what we have attained and which will permit us to develop. By developing, is meant growth and progress and not simply resting on our laurels safe from all competition or comparison.

If, on the other hand, the matter is considered in the light of big business it becomes an entirely different matter and I prefer to leave such a discussion to those better qualified to pass judgment.

To be entirely logical we may only justly claim protection against unequal conditions of production costs. We cannot fairly claim tariff protection which will offset watered stock and dividends thereon, inefficient management, lack of experience, waste or any of the sundry conditions that are not included in the famous "German secret of dye manufacture."

We cannot have a law that will give a preference to England, Switzerland or France. If we restrict foreign dyes we must do so by a general ruling, but that restriction must not be in the nature of a hindrance to American textile interests, otherwise we would be sacrificing a greater industry in order to save a lesser one.

The dyemakers of Switzerland are fully able to cope

with German competition, just as they were before the war. They, too, seem to have the great secret of dye making, which is, after all, common sense efficiency in the trivial matters. We are now convinced that the Germans were not the supermen they claimed to be; they were very strong on organization and efficiency and we should not hesitate to compete with them, protected, as we would be, by the handicap created by a sensible tariff.

THE REAL CHEMICAL SHOW

ACCORDING to the beholder's particular kind of vision, it is man's curse or his blessing that he is doomed perpetually to move forward. He cannot slide back, nor can he remain stationary. He must go on, and be it curse or blessing, none will dispute that it is his fate.

Ever since unknown genius first thought of binding his rounded stone to the end of a stout stick, thereby lending greater power and accuracy to his blow, we have had with us those who have automatically cried out that such an innovation was All Wrong. Probably the invention was no more than an hour old when there appeared the first Reactionary, who said: "This will lead only to sin and sorrow. We were not meant to change the predestined order of things . . . Don't try to tell me!"

Then there must have come into being the first Conservative, who cried: "No, no. This is well enough as it is. Let us keep what we have gained and all will be well. But don't go upsetting things again with fresh innovations."

And we may well suppose—though History had not been invented and consequently was not present to record and back us up—that while all this was being said, the child who later bound the ends of a springy branch with hide or tough bark and with this device sped a pointed shaft at his game, beamed happily upon the assembled company, inserted a chubby finger in his mouth and remarked: "Goo!"

Most of man's inventions for his betterment can be applied for both good and evil effects. It all depends upon who is using them and what kind of a mood he's in. Had there been such things as insurance rates at the time of which we speak, they would probably have gone down when it was discovered that with the bow and arrow one could kill his dinner from afar, thereby greatly lessening the personal risk. But the weapon certainly made warfare more destructive, and enabled one angle of the eternal triangle to quietly remove another angle without leaving near-by tracks for the guidance of the Prehistoric Police. So there, as the saying is, you are.

It is a long stretch from that age to this, but it is deuced short in geological time. We are young yet, and there is much before us. But who shall say there has not been an improvement in our condition! The United States Patent Office is steadily recognizing

the validity of from six to eight hundred new inventions every week, year in and year out, yet this is not so important as the fact that there are few persons nowadays to rise up and proclaim that this Ought To Be Stopped. Man has taken to inventing, improving and perfecting things at a greater rate than ever, and he is fated to go on doing so, at an ever accelerated pace, as long as he remains a creature of this earth. The results of his efforts are called progress.

All around you at the Chemical Exposition this week you may see these results in tangible form. The devices exhibited are so many crystals of Progress from the steadily evaporating solution of Time. But the true Progress has taken place in the minds of those who come to observe, the index of this Progress being found in the manner in which man *receives* new inventions rather than in the inventions themselves; for by his readiness to assimilate is measured his ability to enjoy the advantages of his inventions wisely and well.

People are no longer put in jail for creating innovations. It is no longer though sacrilegious to adapt natural phenomena to the uses of mankind. We are yearly becoming more liberal, more tolerant and more open-minded. Larger masses of people think the same thing at the same time than ever before in the history of the world. Trains and the telephone are battering down sectionalism. Some day, depend upon it, the airplane, the wireless telephone and other devices not yet thought of will have battered down nationalism—that is to say, national self-consciousness, which is **not** to be confused with patriotism. It is man's blessing, not his curse, that he progresses.

Many outsiders will come to the Chemical Exposition this year in the belief that the exhibits constitute the show. Those on the inside know better; they know that the exhibits in the booths are mere accessories and that the real show consists of the people themselves, each mind a booth exhibiting man's triumph over superstition and inertia. That is a far more important victory for the human race than the conquest of the chemical elements, since without it the latter cannot long continue.

TWENTY-EIGHT MONTHS—A BRIEF HISTORY OF THE STRUGGLE FOR AN AMERICAN DYE MEASURE

WHEN the Sixth Chemical Show last year opened its doors to the trade and public in Grand Central Palace, Congress had then been dawdling over dyestuff legislation for sixteen months. On the occasion of the previous exhibition—the fifth of the line—The REPORTER editorially expressed its profound regret that so much delay had been necessary and, in company with other trade periodicals, confidently assured its readers that the advent of the Sixth Show would see limited dye protection long since in full operation.

During both the Fifth and Sixth Chemical Expositions the Sixty-sixth Congress, of which great things had been expected, was in session. On looking over the files, we recently ran across the following in a REPORTER of more than three years ago. "The question of the personnel of the next, or Sixty-sixth, Congress is one which should be of particular interest to both manufacturers and consumers of dyestuffs. There is no doubt but that there will come before this Congress numerous questions of more or less moment to the dyestuff industry. . . ."

Six weeks later came the election, and in the following March the new members were duly installed. In May, "H. R. 2706" was introduced, increasing the tariff rates of the act of September 8, 1916, and providing for a licensing system. The Ways and Means Committee reporting this bill favorably, the House passed it during the very week of the Sixth Chemical Show that Fall, and it went to the Senate as "H. R. 8076." Then the real struggle for recognition began. The Senate referred it to the finance committee and the committee began an investigation into this measure which had been approved by the House. It held hearings; it took testimony; it appointed a subcommittee; the subcommittee reported the measure, with modifications, back to the committee and the committee reported it favorably to the Senate. But the latter had the Peace Treaty under consideration at that time; it was about to recess for the Christmas holidays, and contented itself with passing instead the Penrose resolution extending the existing licensing system to prevent our markets from being flooded when the ratification of the Treaty—which action was then momentarily expected—should bring to an end the special war legislation that had been doing duty as a temporary safeguard.

On one occasion the Dye bill was brought up before the Senate, but did not come to a vote within the time limit set and was sent back to committee. In the Spring of 1920, just before adjournment time, it was again brought up for consideration but was filibustered to death by former Senator Thomas, of Colorado. The Summer dragged along and then came Fall, bringing with it the Sixth Chemical Show, but Congress was not scheduled to reconvene until December and nothing could be done. In December a far more rigid dye protective measure was introduced in the free-trade Parliament of England and passed both Commons and Lords and was signed by King George within that same month! Yet, although hopes ran high for a week or two, this example did not stir the Senate, which continued to let the dye question severely alone, so that when in March of the present year the Sixty-sixth Congress quietly flickered and went out it had left a record of no more positive action on a measure which it had in its possession continuously for twenty-two months than the mere extending of already existing legislation.

Thus passed the first six months after the 1920 Chemical Show. The Sixty-sixth Congress bequeathed the dye problem to the Sixty-seventh, and that was all.

Six months more have passed, and the situation has changed not a bit so far as the reaching of a final decision is concerned. Nevertheless, they have not been entirely uneventful months, and one or two factors of the greatest import have made their appearance.

Very early in the life of the present Congress the Emergency Tariff act was introduced. This gave six months' special protection to a number of industries and was designed to prevent dumping while the Fordney Permanent Tariff was being whipped into shape. To the Emergency measure was added the Knox amendment, dissolving the War Trade Board but extending its protective powers, so far as the dye industry was concerned, to the Treasury Department. This amendment passed both House and Senate successfully, but due to the fact that it was part of another bill, which bill was obliged by Senatorial dissension to go to a joint conference of the House and Senate, and in spite of the additional fact that the dye amendment was designed solely to bridge the gap between the removal of special war protection and the granting of special peace protection, this amendment alone was singled out by the conferees for having its legal duration cut from six to three months. In this form it was passed as the Dye and Chemical Control act and was signed by President Harding on May 28.

Meanwhile, the House Ways and Means Committee had been working on the Fordney Tariff, containing in its present ideal form the Longworth Limited Embargo section, best and fairest measure yet devised for the protection of dye manufacturers and consumers alike, and on July 29 this bill was introduced. It contained five separate sections—a record number for a tariff measure—and sitting as a committee of the whole, the House approved the dye section with a margin of nine votes to spare. But political considerations began to take precedence over common sense and later, when the House passed the Fordney bill the limited embargo feature was eliminated by a margin of nine votes.

Minus the limited embargo, the bill went to the Senate and was referred to the Finance Committee. The latter further referred the dye section to a special conference committee composed of two Senators and two Representatives—which had not rendered a report at the time when Congress recessed last month.

But while the Senate committees, subcommittees and conference committees were arguing over the provisions of the permanent tariff measure, the three months of protection allowed the dye industry by the temporary law were rapidly being exhausted. Seeing this, Representative Nicholas Longworth, father of all the Dye bills, proposed the so-called Longworth amendment to the temporary law, replacing the three months removed by the conference committee and thereby further extending the time of protection from August 27 to November 27.

Then, while this amendment was in the House Ways and Means Committee, came the most significant and hopeful development of the year in the form of President Harding's letter, accompanied by the letters of Secretary of Commerce Hoover, Secretary of War Weeks and Secretary of the Navy Denby, asking its prompt passage.

The effect was electrical. The House passed the amendment by a vote of 186 to 91 and shortly afterward began its recess. Responding to the President's appeal, the Senate even tried to extend the protection until January 1 and was prevented from doing so only because the House was not in session to approve. But the House measure was passed with little or no opposition on the last day of the Senatorial session late last month.

This, then, is the situation at the opening of the Seventh Chemical Show: After twenty-eight months of deliberation over the dye question, the net result is—nothing! The industry is safe until November 27, and the Dye bill is buried in committee.

The damage and delay to development occasioned the dye industry by these months of uncertainty is incalculable. At least one of our Senators has accused the dye industry of growing too large, too efficient and powerful—proclaiming it well able to cope with Germany's experienced color manufacturers—and in the same breath has denounced it for not producing more of the rare and highly complex dyestuffs which are Germany's especial pride. The answer is that for the past twenty-eight months the industry has never known from one week to another whether it would be obliged to close up many of its works and bid good-bye to its invested capital. Most of the larger concerns have ceased from all research work, and the industry alone among those represented at the present Show is in a state of mental fog which is no part of the effect of the recent business depression.

The events of the past year have demonstrated one thing with great clearness, namely, that such remedial legislation as may be adopted for the relief of the dye industry has no place in a tariff bill, since the question involved is positively not a tariff issue. And they have also shown that since political bargaining was the cause of the elimination of the dye provision from the Fordney permanent tariff in the House, a dye bill has no place in any other sort of measure whatsoever. This is an issue which can stand upon its own merits, and which must not be confused nor bargained for.

The most important development of the year was easily the outspoken attitude of the Administration and the prompt response of Congress thereto. Unless all signs fail, President Harding is well aware of the dye industry's need for a special form of protection for a limited period, and he means to put an end to the dilatory tactics which are set forth in the record given above. Viewed as a whole, the significance of that record comes home with telling force; it is not, to

speak plainly, a record for a legislative body to be proud of.

After twenty-eight months spent in closely following every development in the legislative situation. The REPORTER asserts its belief that the Longworth limited embargo in its present form is wholly unobjectionable to the dye consumer, that it is incapable of leading to the growth of a dye monopoly in this country, and that at the same time it is the only law which will allow the American industry to fit itself for open competition with the German trust three years hence.

And in view of the shortness of the time remaining and the impossibility of completing its attempted education of the public, we further believe that the industry may well base its principal hopes upon the potency of Mr. Harding's future pronouncements.

THE DEVELOPMENT OF FRANKLIN DYEING

(Concluded from page 27.)

making repairs, and also to the motors, which are all located below the first floor. This leaves a maximum amount of room on the first floor for operating the machines, as there is none of this valuable space taken up with motors and belts. A dyehouse of this size would ordinarily require an expensive ventilating system to make living conditions bearable, and to prevent condensation and dripping, but in this case it is not necessary, as there is practically no steam escaping from these machines.

One reason why it is so easy to get common labor at a low rate to operate a Franklin dyehouse is because the working conditions are perfectly comfortable, due to the fact that there is little damp, foggy steam in winter, or humid heat in summer.

In conclusion, it can be said that the Franklin machine has proved absolutely that the modern method of forcing the dye in solution through the material is far preferable to the centuries-old one of dragging the material through the solution containing the dye; for no matter how much care is exercised in accomplishing the latter, the resulting color is far more uniformly even, and the material is left in far better condition, when dyed by the former modern method.

THE TEXTILE LABORATORY AND ITS EQUIPMENT

By CHARLES L. HOWARTH, B.T.C.
Instructor, Lowell Textile School

IN equipping a textile laboratory, the nature of the work done there should be taken into consideration. This work is of a varied nature and may be divided into three classes, namely: textile testing, dye testing, and chemical analysis.

Textile testing consists in determining the consti-

tution and construction of a fabric or yarn, and the tensile strength, weight and composition of the fibers. Dyestuff testing consists in the investigation of shipments to see that they are up to the standard, and in the testing of new dyestuffs and their fastness to various color-destroying agents, thus determining the uses to which they may be put. Chemical analysis is confined principally to the analysis of incoming chemicals and supplies, and the analysis of various compounds which are bought with the idea of later manufacturing them at one's own plant—which is always advisable, since it results in a saving of money.

LOCATION

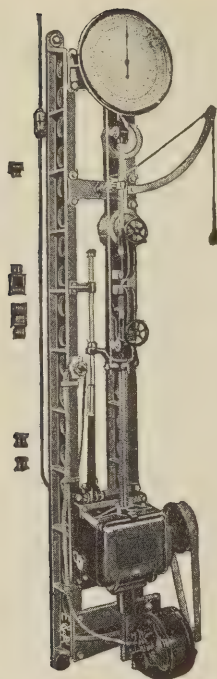
In selecting a site for a laboratory, the following points should be considered: The laboratory need not consist of elaborately laid out rooms, but it should at least provide satisfactory working conditions if it is expected to be of any value. It should be well ventilated in order to carry off steam, thus not only making it more habitable during warm weather but preventing moisture from getting at the books and samples, as well as the balances and other apparatus. In some cases the laboratory is partitioned off into separate rooms, in which event all the dyeing and work requiring steam is carried on in one of these. The laboratory should be well lighted and should have one or more windows facing north, so that an evenly diffused light is available for color matching and the examination of dyeings.

TESTING OF TEXTILE FABRICS

Textile testing is mainly a physical proposition, and the following apparatus is necessary to carry it out.

For determining the tensile strength of yarns and fabrics there are many types of machines. The action of these machines depends either upon springs or the raising of a given weight through a given space. The dead-weight type is in more general use than the spring type. There is little about the dead-weight type to cause error, while the tension in the spring type may vary with the temperature, careless handling and imperfections in the springs themselves. These machines are both hand and power driven. The power-driven machine is to be preferred, since more accurate results may be obtained. The revolutions per minute are constant, while with the hand tester the speed may be varied, giving a variable result. Strength testers are made both for yarn and cloth, and combination machines for both yarn and cloth.

In testing knit goods and some kinds of silks the bursting strength is required. This is obtained by use of the Mullen tester. The material to be tested is clamped in the machine over a rubber diaphragm. Pressure is exerted on the diaphragm through glycerine by means of a hand screw until the material is broken. The breaking pressure is recorded on a dial on the machine.



Motor Driven Universal Tester

The twist counter is used to obtain the number of twists per given length of yarn. Samples of from 1 to 10 inches are clamped in jaws provided for the purpose, and by revolving the hand wheel until the yarn lies straight and the fibers parallel, the twists in the length of yarn are recorded on a dial. This dial is graduated from 0 to 50, both for right and left twists, and has a stationary pointer.

In order to determine the construction of cloth, a pick counter is necessary. The regular $\frac{1}{2}$ - or 1-inch pick glass obtainable at most optical goods stores answers the purpose as well as the more elaborate and expensive devices. For ordinary work the $\frac{1}{2}$ - or 1-inch glass is to be preferred to the $\frac{1}{4}$ -inch glass, as more accurate work is obtained with the former.

A torsion balance for cloth will be found a great help if many weight determinations are to be made. A square of cloth 2 x 2 inches is cut with a die and placed on the beam of the balance at a figure corresponding to the width of the fabric. The apparatus is then balanced by moving a rider along the beam, and when balanced the position of the rider indicates the weight of the fabric per yard.

ANALYTICAL WORK AND DYE TESTING

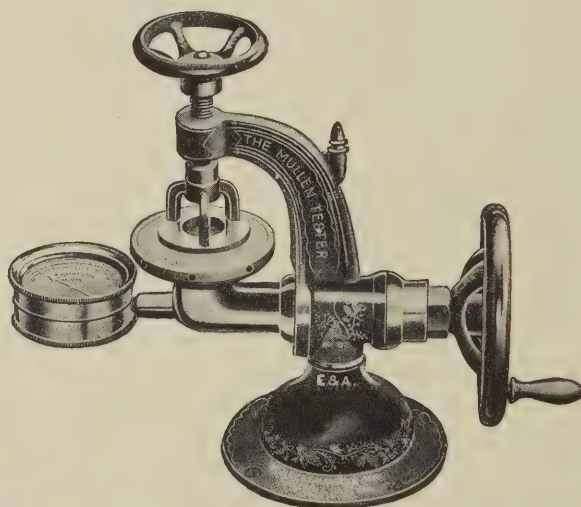
The laboratory should have a good analytical balance and an accurate set of weights. A rough balance will be found of great convenience in weighing out skeins of yarn and swatches of cloth for dyeing, and for weighing out chemicals where great accuracy is not required.

In order to determine the moisture content of textile fibers some sort of a conditioning oven will be necessary. There are several types on the market. In the use of one of the common types the material is

weighed in a wire basket and dried in the oven at 110 deg. Cent. to constant weight. The dry weight is taken while the material is in the oven.

In a textile laboratory there is usually a great deal of work with dyestuffs, such as testing new dyestuffs, testing shipments of dyes, and matching colors. The first requisite for this work is a dye bath. This is a means of heating the dye beakers uniformly, which is impossible with a gas flame. There are several types of dye baths in use. The two most generally employed are heated with steam or gas. If possible, a steam bath should be used. These baths generally hold twelve dye beakers and should boil at 120 to 130 deg. Cent., so that the liquor in the dye beakers will actually boil. Glycerine, calcium chloride, or sodium nitrate and Glauber salt are used. Glycerine should be avoided, since on long heating it decomposes, giving off objectionable odors. Calcium chloride, although cheap, has the disadvantage of boiling over. The sodium nitrate and Glauber salt solution has none of these objections. Recently an air oven heated by gas has come into use. This is known as the Du Pont oven. The dye beakers set down into the oven and rest on an asbestos mat over a ring burner. They are heated on all sides by hot air. This is by far the best dye bath using gas.

Dye beakers may be obtained in porcelain, glass or



Mullen Tester

enamel ware. Porcelain, of course, is the best, but the cost is rather high. Glass answers the purpose very well, but, on continuous heating of the beakers, becomes brittle and cracks. Enamel ware is cheap, withstands the action of chemicals in the dye bath, and may be used to good advantage.

Stock solutions for testing dyestuffs should be kept on hand. In addition, some chemicals are necessary. The following should be in stock: Sulphuric, nitric, hydrochloric, formic, acetic, oxalic and lactic acids; caustic soda, soda ash, sodium bicarbonate, borax, sodium sulphide, sodium sulphate, sodium bisulphite, sodium bichromate, common salt, sodium perborate,

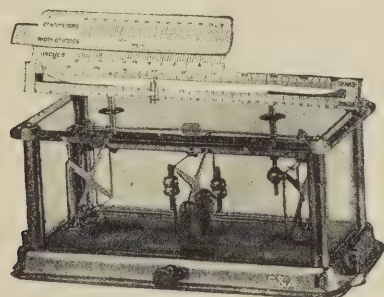
sodium chlorate, potassium permanganate, hydrogen peroxide, bleaching powder, stannous chloride, lead acetate, copper sulphate, ammonia, alum, potassium ferrocyanide, potassium ferricyanide, hydrosulphite.

A drying closet to dry dyeings may be made by enclosing a small radiator or a steam coil. The dyeings are hung on sticks in this closet to dry. The dyeings should always be allowed to cool off in the air before examining them, as some colors change when they are heated.

A flatiron is necessary if dyeings are to be made on cloth, or for testing the fastness of colors to hot pressing.

In order to determine specific gravity a Westphal balance should be used where great accuracy is demanded. When less accuracy is required, hydrometers may be used. The laboratory should be equipped with Twaddle, Specific Gravity and Beaume hydrometers.

Both Fahrenheit and Centigrade thermometers should be on hand.



Cloth Calculating Torsion Balance

The fastness of dyestuffs to light is very important. Where this is required, the dyed sample is fastened to a board with copper or galvanized tacks and exposed to sunlight in a glass-covered case. The bottom of the case is not boarded up tight, but is made of slats to permit ventilation. The top and sides of the case are tight, so that moisture will not enter the case. The dyed samples are exposed to the sunlight for the required time. If the result of the test is required in a short time the sample may be exposed under an ultra-violet lamp, or an arc light, of which the "fadeometer" is an example. The action is much more rapid than sunlight. For a weather test the swatches are exposed to the weather (i. e., combined sun and all atmospheric conditions) for the required number of days.

Cards to mount the dyed samples will be necessary. They should have cuttings of the original dyeing and cuttings showing the results of the various tests made on the color.

A small skein winder and reel will be necessary to wind small skeins for dyeing.

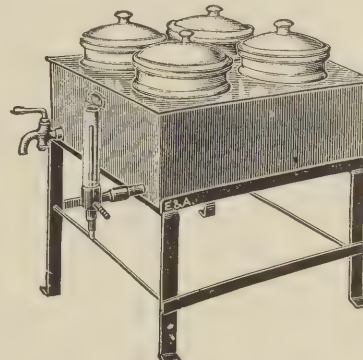
A steam-jacketed kettle of 5 to 10 gallons capacity will be found a great convenience for heating water to dissolve dyestuffs, etc.

Graduated flasks, cylinders and pipettes of various sizes will be necessary.

CHEMICAL EQUIPMENT

The chemical equipment consists of apparatus and reagents used in testing incoming supplies and analyzing substances with the idea of duplicating them. The general laboratory equipment consists of reagent bottles, beakers, burettes, filters and any other apparatus which the chemist may find useful.

If grease, soap or indigo extraction tests are to be

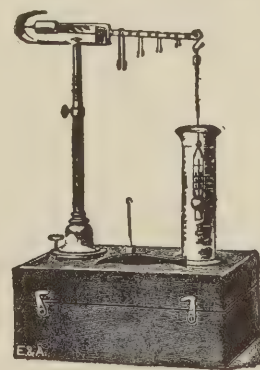


Water Bath for Dye Laboratory with Porcelain Dye Beakers

made, a Soxhlet extraction apparatus is necessary. In running ether extractions an electric hot plate should be used.

WORKING LIBRARY

One part of the laboratory that is often neglected in many plants, but a part which is necessary for the best results, is the library. This should contain up-to-date books on chemical work relating to the work of the plant and current journals dealing with the industry. The chemists should have access to this reference



Westphal Specific Gravity Balance

library, thus keeping them posted on new methods of analysis and new ideas relating to the work carried out in the plant.

Of course, the above equipment is not necessary for all plant laboratories, and in equipping a laboratory only the apparatus useful to the special needs of the plant concerned need be selected; but it is my opinion that any money invested in a laboratory will ultimately be the means of saving many times the original investment.

Salient Points in the Dyeing and Finishing of Velours

Description of Proper Velours Construction—Directions for Fulling and Washing—Napping—Dyeing—Dry Finishing and Shearing

By GEORGE E. TEMPLETON

Dyer, Brown Woolen Mills, Ltd., and Brook Woolen Company, Ltd., Simcoe, Ontario

THERE are many grades of velour cloths on the market—some good, some bad, and some that should never be classed as velours. Some are real velours, while others are poorly constructed and poorly finished imitations. Many of them are faded, though not as many faded garments are on the market this year as in previous years. In this article it is intended to touch upon the more vital points that tend to make a velour what the name really implies.

CONSTRUCTION OF VELOURS

Among samples of velours examined from various parts of the country were found velours in broken twills, 4-harness twills, 3-harness twills, or 2-up-and-1-down weaves, where the back was used for the face. The reason for this, it is assumed, was because the filling was on the face and the warp on the back. And by taking the warp side for the face, after napping and shearing, a sort of velour effect was dominant but had the appearance of a face-finished cloth similar to a broadcloth. The idea was, perhaps, all right, but the trouble was that it never matured. Another cloth was made of a plain weave one-up-and-one-down, finished as near a velour as could be obtained (from such a construction) on one side and a plain homespun finish on the other side.

However, an excellent velour for fall and winter weight coating may be made as follows: Seventy-five per cent of fine clothing wool, 25 per cent of noils of a similar quality, 1,640 ends, 28 picks, 1½-run yarn warp and filling, 8-harness straight draw 70 inches in the reed, 26 ounces loom weight, to finish 20 to 21 ounces. This fabric should be milled in the grease to 56 inches, reversed during the fulling operation, and milled with a soap of sufficient body and strength to "stand up" during the entire fulling. (Soap that does not "hold up" and show a heavy body when the cloth is pressed between thumbnail and finger either does not contain enough soap to the gallon or is of insufficient strength to overcome the grease or foreign matter in the fabric.)

WASHING

After fulling, enter goods in the washer, letting in enough water to cause the soap to saponify and work up to a "suds," and run for twenty to thirty minutes. Rinse until practically clear and resoap, using just enough soap to work up a good lather. If the fulling soap has done its work no trouble will be experienced during the second soaping. Work the goods in this soap bath for about twenty minutes, then rinse thoroughly until no trace of soap or alkali is apparent. When the goods look as if they were ready to cool it is good practice to make a test, and this is a simple matter. Catch a glass of water from the outlet of slush box under the rollers and drop a very small amount of phenolphthalein in the glass. If there is any trace of soda or alkali in the water the same will show a pink cast, and if the water remains clear it is apparent that no alkali is present; and it is then safe to assume, if such is the case, that the soap is rinsed out as well. It is perhaps well to mention that the water used should be between 100 and 120 deg. Fahr., and there should never be any occasion for using water any hotter than 120 deg. Fahr. Excessively hot water only tends to destroy the "feel" of the fabric and causes the fibers to felt, giving a "mushy" feel; and very often too hot water will set the grease rather than remove it.

Fuller's earth is worthy of mention; it is an excellent cleanser, as well as imparting a "kind" feel or handle to the goods. It may be dissolved or stirred in a barrel of warm water and added to the washing bath just before the final rinsing. In former years fuller's earth was extensively used, and is to-day in some of the finer goods mills.

NAPPING

After washing and extracting, the material is sent to the napping machine and napped on one side only, and all one way, with a short nap until the weave or "teeth" of the fabric is apparent when the nap is parted. A penknife may be used to part the nap. The nap should stand as nearly straight as is possible. Cropping or wet shearing may be done at this stage, if desired, although it is not necessary.

DYEING

After the requisite amounts of acid, Glauber salt and dyestuffs have been added to the dye bath at a temperature of not over 125 deg. Fahr., the goods should be entered and run in with the "run" or "lay" of the nap, brought gradually to a boil, and boiled until the bath is exhausted or the desired shade is obtained. The goods are then slowly cooled and rinsed, extracted, and returned to the finishing room. Goods of this character may be dyed with chrome colors, but as a rule acid dyes of that level easily are preferred, owing to the saving of time in their application.

DRY FINISHING

After drying, the goods should be examined over a rough perch, or so-called "roughly" examined, to determine whether or not they have been properly dyed. It is much easier to discover at this time, rather than wait until the final examination takes place, that some trouble has arisen which should have been detected before the goods had been finished.

The pieces are then renapped, just enough to raise up the previous nap, and then sheared. And it is in the shearing that a great many velour cloths are spoiled. To obtain a good velour finish the raising

brush that is ordinarily on a shear should be taken off and replaced with another roller covered with straight fancy clothing wire about an inch long. This wire brush is then set into the nap and the speed of the roll adjusted so as to be just fast enough to raise the fibers straight. The blade is then gradually lowered with each run until there is not enough nap left to "rough up," when rubbed either up or down, but sufficient to cover up the texture or weave of the fabric. After shearing, steam and press lightly, and then re-steam after pressing. The material is then either run through a conditioning machine or allowed to cool and condition in a damp or cool room.

In some mills the goods are carbonized in the piece, but it has been the writer's experience that the use of carbonized stock gives better results than carbonizing in the piece. This may seem to cost more money, but if a record is kept of the number of seconds that is caused by carbonizing in the piece the cost of using the right kind of stock in the first place is readily offset, especially with the price of wool as it is to-day.

Very little trouble, if any, will be had if a good grade of wool oil is used in the emulsion, if the finisher sends his good to the dyer clean, and if, again, the dyer is particular as to the types of dyestuffs he chooses. And it generally is the "ifs" that cause the trouble.

Causes of Cloudy and Shady Effects in Worsted Piece Dyes

Causes Which Have Been Found to Be Common in More than One Plant—Unskilled Handling of Temperature—Cloudy Effects from Wet Finishing—Streaky Pieces and Two-Color Effects from Wet Finishing—Listed and Shady Effects from Wet Finishing—Imperfect Pieces from Dyeing

By KARL R. MOORE

Chemist, Stillwater Worsted Company Harrisville, R. I.

ON account of wide differences in quality, construction, processing, etc., existing in various mills, it becomes impossible to make statements concerning conditions and operations found to be contributing causes in the production of imperfect pieces in certain plants that would be applicable in locating similar troubles elsewhere. The object of the writer is not, therefore, to outline any hard and fast rules for governing operations or selection of materials, but merely to recommend some methods that have been found useful in overcoming imperfect goods and to record some causes that were common in more than one plant.

It is obvious to all those handling it that the worsted fiber, like a tender plant, is easily affected by heat and cold, alkalies and acids. Therefore, unskilled handling of hot and cold water and lack of uniformity in the application and removal of chemicals and other foreign matter will have a pronounced effect on this fiber. Un-

fortunately for those concerned with the manufacture of piece dyes, this effect does not become visible until after the piece is dyed. The worsted fabric also enjoys, to a certain extent, the most valuable quality in a lamp wick, and when wet, or damp, water travels through it, generally downward, with great ease, carrying with it any foreign matter that is soluble. The effect of this will be noticed after dyeing. A careful analysis of all materials that affect the worsted fiber in this manner, keeping in mind their suitability and uniformity and locating definitely the operations in which they are applied or removed, if carried on under the observation of some one who can check up chemically the judgment of the overseer, will be of assistance in eliminating imperfect goods.

CLOUDY EFFECTS FROM WET FINISHING

Incomplete emulsification and subsequent removal of the spinning oils will cause clouds to appear in the dyed

goods. The reasons for this may be either in the materials used or in the processing. Regarding materials, the best adapted soaps for the gray goods scour are made from an olive foots stock or saponified red oil free from unsaponifiable matter. The presence in a soap of drying oils, such as corn or cottonseed, lower its scouring value, and the presence of high titer tallow stocks renders the removal of the soap emulsion more difficult. For light weight goods and those of open construction a pure olive foots or red oil stock cleans excellently, while with heavier weights, close constructions and high-pick work, the olive functions better when combined with a little low titer tallow. Usually these soaps are made up from four to six ounces to the gallon built up with soda ash or modified sodas, and a little silicate of soda added to aid in the penetration and grease removal.

In processing, the use of two soapings, especially with goods above twelve ounces—the first a heavy soaping and the second much lighter with a draining down but no rinse in between—was found to give cleaner results than a single soaping or two with a rinse between. With light weights the stringing of two pieces to the pot-eye gave a better penetration of the soap through the piece, and a cleaner piece in a shorter time, than one to the pot-eye. Adjusting the processing in regard to the time and quantity of soap, etc., to the construction of the piece rather than to its weight, showed that fourteen-ounce pieces of open construction with split weaves scoured out clean in less time, and with less soap, than eleven-ounce pieces of regular serge construction. In all operations of wet finishing, advantage can be taken of the spongelike character of the worsted piece, and for uniform results with any process, care should be taken that the pieces after the first rinse before soaping contain at all times as near the same amount of water as possible, and that they are not merely drained down but that considerable water is squeezed out. If this is done, the soap solution will penetrate the pieces much faster and a cleaner scouring will result. It is also necessary to see that the pieces get all the soap they need, and in this connection it may be stated that because a soap foams up all over the washer it does not necessarily follow that it has high scouring value.

The relative cleanness with which different soaps and different processing will scour a set of pieces is very clearly shown by the subsequent action of the set in the dyehouse. The length of time taken for the set to come to shade on a fixed formula shows at once whether the new soap or method of processing is more efficient than the old.

STREAKY PIECES AND TWO-COLOR EFFECTS FROM WET FINISHING

The above two forms of imperfection usually occur together, although a two-color effect will come from a difference in stock in warp and filling without causing any streaks in the piece.

Streaky effects are caused by the incomplete removal

of the warp size, and are invariably accompanied by a two-color effect. When such a defect occurs the condition is improved by a very thorough rinsing of the gray goods before putting on any soap, starting with cold water and gradually increasing the temperature to 120 to 130 deg. Fahr. running away continuously through the drip box for a period of about an hour. If such pieces occur in quantity, an investigation of the sizing materials should be conducted. The presence of potato starch in a sizing material should be avoided on account of the difficulty with which it is removed.

LISTED AND SHADY EFFECTS FROM WET FINISHING

This form of defect is by far the most numerous one found in the general run of piece dye plants, and is the most difficult to overcome. With cloudy or streaky pieces the defect is so marked that measures to prevent their recurrence are started at once, but, in the case of the above, the list or the shadiness is often so slight that pieces get out to the spongers—especially during periods of falling prices!—before the defect is noticed.

Listed pieces, or those in which there is a difference in shade from side to center running uniformly through the piece or part of it, may be traced to operations through which the cloth passes in open width, such as crabbing or decating, for the inefficient performance of either of those operations will inevitably result in a listed effect after dyeing. If, for example, the goods are poorly crabbed, the steam during the subsequent decating endeavors to force its way between the folds of the cloth towards the selvage, and in so doing it carries with it any grease or soap left in the cloth, causing a dark list. Decated goods are very liable to lists, especially at the lower end when vertical blowers are used. A listed appearance can also be put on in the dry finishing operations of brushing and shearing, and a close examination of the fabric will usually reveal this.

The appearance of a difference in shade from side to center at irregular intervals throughout the piece, sometimes light on one side and a few yards further the reverse, is due to the same causes in a less degree that produce cloudy effects, viz., the inefficient cleaning of the gray goods, insufficient time for scouring or rinsing, or not enough soap. A shady or cloudy effect can also be brought about by poor speck-dyeing, such as using too little water in the washer during the operation, etc. Another form of shadiness, called "shaded in the piece," and revealing places in the piece at intervals where the shade is slightly darker than the preceding portion, when not occasioned by mixed filling, is often due to the stoppage of the slasher during sizing and the baking on of the size at this particular point.

IMPERFECT PIECES FROM DYEING

Without attempting to go into a discussion of the level-dyeing qualities of various dyestuffs, and the potency of colors that are not level-dyeing in causing cloudy and

streaky goods, there are a few general precautions that are necessary even with the most level-dyeing colors obtainable. With chrome mordanted pieces the chrome should be pailed on first, and the tartar dissolved cold and pailed on afterwards. With most tartar manufacturers the term "half-refined" tartar has seemed to mean to put in half argols and half bisulphate of soda. If this mixture is pailed on first it leaves the cloth in an acid condition for the reception of the chrome. After the goods are chromed they should be dyed as quickly as possible on account of the chrome salts being affected by light. With many half-refined tartars at least 5 per cent is needed properly to reduce 3 per cent of chrome. In

putting on the color, if any color is dissolved in ammonia for better solution, that color should be pailed on first. In many dyehouses it has been found that not only the dyer, but most of the dyehouse hands, possess an excellent working knowledge of the effect of acetic acid on the length of time in which their kettles would come to shade and thus finish responsibilities for the day, and if not carefully watched they will be very generous when weighing out or putting on the acid. With very heavy weight goods, if the dyeing is not coming well with eight pieces to the set, sometimes better results can be obtained by cutting down the number of pieces and leaving more room in the kettle.

The Control of Bleach-House Processes

Determination of the Strength of Sour Baths Used in Conjunction with Chlorine Bleach

By H. W. EASTMAN

IN many bleach houses it has long been the custom to control the strength of the sour liquor by means of the Twaddell hydrometer. Unfortunately, the reliability of this instrument is dependent upon the purity of the acid used in preparing the sour, and upon whether the baths are freshly prepared each time when required.

The Twaddell hydrometer registers the true gravity of a liquid, and consequently if the liquid contains a pure substance, which increases the gravity, then the amount of the substance contained therein can be accurately determined by means of this really excellent instrument. In case an impure acid is used, or the used baths are replenished to required strength, then the use of the Twaddell hydrometer is unreliable, owing to the different impurities which contribute to the contamination of the bath.

HOW INACCURACIES MAY ARISE

For instance, if the cotton material is insufficiently washed following the bleaching operation, the salts of soda or calcium will be introduced into the sour well, depending upon whether a calcium or sodium hypochlorite bleach bath has been used, thus producing sodium sulphate or calcium sulphate.

The sodium or calcium sulphate thus produced increases the gravity of the solution, as shown upon the Twaddell hydrometer. In the course of time a constantly replenished sour bath becomes so saturated with impurities, which easily register an increased gravity with the Twaddell hydrometer, that no dependence can be placed upon the results obtained with this instrument.

It is customary to use a standing bath of the sour liquor, and this needs to be replenished to the proper strength after each lot of material is processed.

In the case under consideration, a simple, rapid and

accurate chemical control can be inaugurated which will assure at all times a positive knowledge of the acid strength of the sour liquor.

The sour solution is based upon a strength of approximately a 1 deg. Tw. solution, equivalent to 1.005 specific gravity.

PREPARATION OF SOUR LIQUOR

This strength is attained by adding oil of vitriol 66 deg. Beaume to water in the sour tank, so that each 100 gallons of sour liquor when ready for use contains 8 pounds of oil of vitriol.

MANIPULATION OF CONTROL

The acid content of the sour liquor is ascertained by titration against a normal caustic soda solution, using phenolphthalein as an indicator.

The process is carried out in the following manner:

First.—Ascertain the capacity of the tank containing the sour liquor, indicating on a properly marked gauge stick the total number of gallons contained therein at varying levels.

Second.—Mix the contents of the tank thoroughly.

Third.—Withdraw, by means of a pipette, 100 c.c. of the exhaust sour liquor and place in a suitable receptacle. Add 2 to 3 drops of phenolphthalein test solution (1 gram phenolphthalein dissolved in 100 c.c. alcohol). Add from a burette such a volume of normal caustic soda solution (Note 1) as will just impart a pink cast to the solution after a thorough shaking. Record the number of cubic centimeters of caustic required.

Note 1.—Normal caustic soda contains 40 grams caustic soda (NaOH) in each 1,000 c.c. of solution. This is equivalent to 49 grams sulphuric acid (oil of vitriol) (H_2SO_4) per 1,000 c.c. of solution.

EXPLANATION OF CONTROL TABLE

The accompanying control table is arranged as follows: The capacity of the sour tank, shown in gallons, appears in the top row marked 100 to 500, inclusive. The row at the extreme left shows varying amounts of cubic centimeters of normal caustic soda from 0 to 20 required to neutralize the acidity of 100 c.c. of the liquor in the sour bath. The figures within the inner columns represent the number of pounds of oil of vitriol required to restore the sour bath, when filled to proper level with water, to an acid strength corresponding to a true 1 deg. Tw. reading.

If it was considered desirable, further columns could be introduced covering capacities of additional 25, 50 and 75 gallon units, in which case it would only be necessary to insert the proportionate one-quarter, one-half or three-quarter increased amounts over the unit value in the table. By the same method a table covering the capacity above 500 gallons could be easily formulated.

CONTROL TABLE					
———Capacity in Gallons———					
C.C.	100	200	300	400	500
Normal					
Caustic	———Pounds of Oil of Vitriol———				
Soda					
0.....	8.0	16.0	24.0	32.0	40.0
1.....	7.6	15.2	22.8	30.4	38.0
2.....	7.2	14.4	21.6	28.8	36.0
3.....	6.8	13.6	20.4	27.2	34.0
4.....	6.4	12.8	19.2	25.6	32.0
5.....	6.0	12.0	18.0	24.0	30.0
6.....	5.6	11.2	16.8	22.4	28.0
7.....	5.2	10.4	15.6	20.8	26.0
8.....	4.8	9.6	14.4	19.2	24.0
9.....	4.4	8.8	13.2	17.6	22.0
10.....	4.0	8.0	12.0	16.0	20.0
11.....	3.6	7.2	10.8	14.4	18.0
12.....	3.2	6.4	9.6	12.8	16.0
13.....	2.8	5.6	8.4	11.2	14.0
14.....	2.4	4.8	7.2	9.6	12.0
15.....	2.0	4.0	6.0	8.0	10.0
16.....	1.6	3.2	4.8	6.4	8.0
17.....	1.2	2.4	3.6	4.8	6.0
18.....	0.8	1.6	2.4	3.2	4.0
19.....	0.4	0.8	1.2	1.6	2.0
20.....	0.0	0.0	0.0	0.0	0.0

In preparing a new sour liquor it is only necessary to add the required number of pounds of oil of vitriol to water in the well and then dilute to the total required gallons with water, after which the solution should be thoroughly mixed. In replenishing an exhausted sour liquor it is first necessary to ascertain the acid strength of the spent liquor remaining in the tank, then determine the total number of gallons of liquor required. Add the required number of pounds

of oil of vitriol and dilute to necessary volume with water.

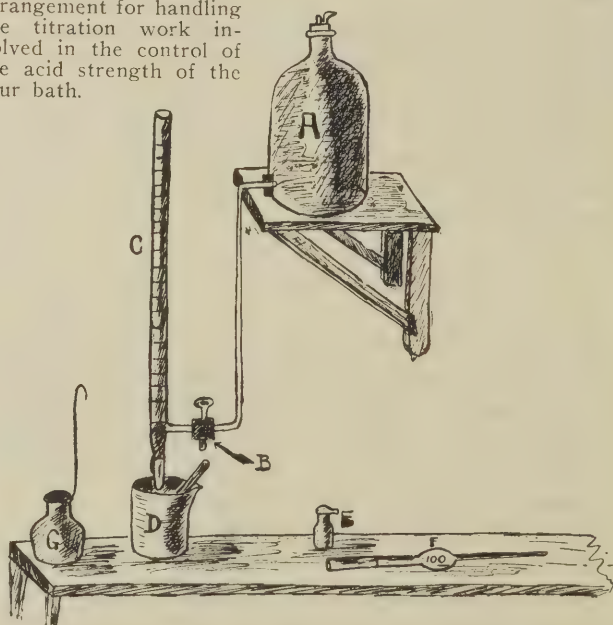
Example.—If a new sour bath is to be prepared and a volume of 300 gallons of liquor is required, proceed as follows: Weigh off 24 pounds of oil of vitriol and add to water in tank; dilute to 300 gallons, as shown on gauge stick; mix thoroughly. Withdraw 100 c.c. of sour liquor with a pipette and place in glass beaker; add 2 or 3 drops of phenolphthalein test solution. Add normal caustic soda solution from a burette until appearance of permanent pink, 20 c.c. being required if the acid solution has been properly prepared. By reference to table, in column opposite 20 and under 300, will be found the figure zero, which signifies that no acid is required or that the sour bath is the desired strength.

If, in the same column 300, it was found that 100 c.c. of sour liquor required 10 c.c. of normal caustic soda solution, then the exhaust sour liquor would have required 12 pounds of oil of vitriol to restore the bath to the proper strength when diluted to 300-gallon mark with water.

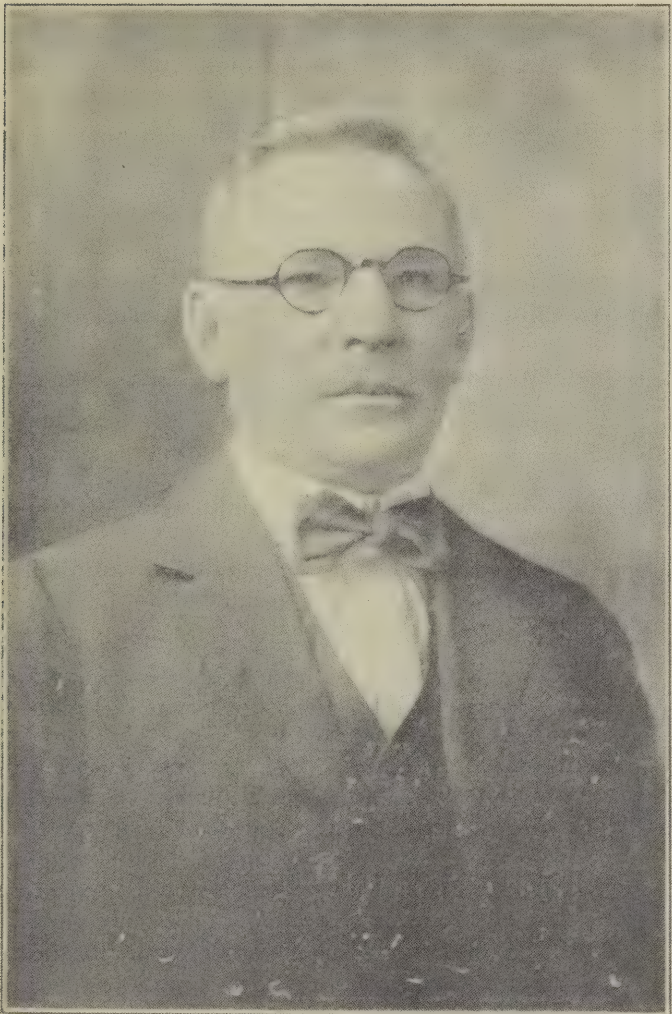
While this control does not purport to be absolutely accurate, it will be found in practice to yield excellent results and to furnish a rapid and efficient means of providing a sour bath the strength of which can be positively relied upon at all times.

ARRANGEMENT OF APPARATUS FOR CONTROL WORK

The accompanying cut shows a very satisfactory arrangement for handling the titration work involved in the control of the acid strength of the sour bath.



- A. $\frac{1}{2}$ Gallon Stock Bottle of Normal Caustic Soda.
- B. Stop Cock at rubber connection between A and C for automatically filling Burette.
- C. 25 c.c. Rubber Tipped Burette.
- D. Beaker for titration.
- E. Dropping Bottle for Phenol Phthalcin Test Solution.
- F. 100 c.cm. Bulb Pipette.
- G. Pint Bottle with Attached Handle for sampling.

A black and white portrait of a man with glasses, wearing a suit and a bow tie. He is looking directly at the camera.

MEN OF MARK in the DYESTUFF FIELD

WM. R. MOORHOUSE

**National Aniline & Chemical Co., Inc.
Boston, Mass**

WILLIAM R. MOORHOUSE was born June 27, 1877, and after receiving his preliminary education in the public schools of Lewiston and Webster, Me., graduated from the Lowell Textile School in 1901. Immediately thereafter he was appointed instructor in the Dyeing Department of that institution, which post he occupied for the next two years. Following this he was connected for approximately one year with Leopold Cassella & Co., Frankfort a.M., Germany, returning to this country in 1903 to serve as textile expert to the Cassella Color Company, with which he was identified for the ensuing fourteen years.

His affiliation with the National Aniline & Chemical Company dates from 1917, in which year he left the Cassella Company to serve with the newer organization. In addition to these connections he also acted as Technical Adviser to the Dye Advisory Committee of the War Trade Board, and to the Textile Alliance, Inc., and since 1907 has been a member of the Board of Trustees of the Lowell Textile School, in the affairs of which he has always taken a keen interest and a very active part.

A friend and associate of many years pays the following tribute to Mr. Moorhouse and his ability:

"I have found him to be a scientific enthusiast and a man whose clear insight into things as they are has not been distorted by visions of what he might like to have them. He possesses a remarkable acquaintance with the coal-tar colors, both of foreign and American make, and this, combined with a thorough knowledge of their application as well as a high type of executive ability, places him among the leaders in the American dyestuff field."

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

C. H. C.—*Question:* I am interested in a study of the general supervision of the dyeing and finishing of woollen goods. Will you kindly advise me as to the ways in which a chemist might be of value in strengthening the link between the dyeing and finishing and the manufacturing processes?

Answer: A chemist can be of assistance in any operation in the manufacturing of woollen goods which involves the application of chemicals to the fiber, viz.: wool scouring, warp sizing, cloth finishing and dyeing. In any of the above operations the chemist can supplement the observation and experience of the overseer by establishing a so-called chemical control, which is simply a chemical proof by analysis that the conditions and ingredients entering into the process remain uniform. The overseer brings to the operation experience in adapting it to various grades of stock, supervision of the help, and an expert knowledge of the mechanical details of the machinery, etc. The chemist working with him is a guarantee of the standardization of materials used and uniformity in their application and control of all factors that will influence the condition of the fiber from a chemical and physical standpoint. The latter is almost equally as important as the former.

As an instance, the man in charge of slashing is well acquainted with the method of cooking up a batch of size, gauging the thickness from time to time by dipping in his fingers. He is also in close touch with the boss weaver, and in that way gains accurate information as to the suitability of the various size for the looms. This is usually, however, as far as his investigation extends, and he is quite unaware of the effect of the varying viscosities of the size solution on the penetration of the warp threads and the difficulties encountered in attempting to remove size from warps unevenly penetrated and carrying widely varying quantities of size. The chemist can, by proper selection and control, secure absolutely uniform penetration and absorption of size by the warp threads, making the problem of removal far simpler. Likewise, in wet finishing the overseer is experienced in the boiling up of soaps and their application to the cloth, but in

judging a soap and its adaptability to the fabric his opinion is based on observation of the body of the soap and an analysis made by placing a small piece of it in his mouth. It is quite as important to know the ingredients of a soap as it is to know the number of pails necessary for a set of pieces.

There is also a natural tendency on the part of department heads, when defective material is produced for which the cause is in doubt, to be able to produce a startling array of alibis for their respective departments and to display remarkable information regarding slack and careless methods in vogue elsewhere in the mill. In cases of this kind the chemist, by careful investigation and analysis, is often able to throw considerable light on the subject.

R. B. N.—*Question:* I am using an after-chromed black on wool shoddy, dyed in an open kettle. The laboratory dyeings are of good shade and fast, but the practical work always comes out reddish and will not stand fulling. How can I correct this?

Answer: In your laboratory dyeing you probably are able to dye the material evenly and chrome it uniformly so that all the black is changed into the dark and fast color, as it should be. When you work in an open kettle, poled by hand, it is not so easy to get the chrome distributed before it has acted on the black. The result is that some portions are overchromed and become rusty, while other parts, not being acted on by the chrome, still retain the red shade of the unchromed black. If you cannot install a stock-dyeing machine for this work you will have to take more time and add the chrome over a longer period of time while poling, so as to distribute it more evenly.

C. K. Co.—*Question:* In dyeing artificial silk it is generally necessary to give it a boil-off to remove oil and grease, but I find that this treatment usually results in a fuzzy condition of the fibers and a loss of strength. Can you tell me of a safe way of treating the silk to remove the oil without injuring the fibers?

Answer: The ordinary boil-off for pure silk is much too severe for artificial silk and results in split ends and weak fibers, but a treatment with about 5 per cent of sulphonated oil at 150 deg. Fahr. will generally remove every trace of oil and not injure the fibers in the slightest degree. Also, it is best not to boil too hard while dyeing, but to work at about 180 deg. Fahr.

M. N. R.—*Question:* How can I dye silk in shades fast to washing for embroidery threads?

Answer: Neither acid nor basic dyes can be made fast enough for this purpose, but you must use direct cotton dyes that will stand after-treatment or development. The ordinary after-treatment with chrome and bluestone is likely to be detrimental to the silk if done too hot, but development after diazotization has no bad effect.

Review of Recent Literature

"The Application of the Coal Tar Dyestuffs." C. M. Whitaker, B.Sc. 214 pages, 5½ x 8½. \$3.00. New York, D. Van Nostrand Company.

Here is a work which can be recommended to the attention of both the superintendent of dyeing and the advanced student of the application of synthetic organic dyestuffs. Too often does the latter emerge from his period of training with a mind so crowded with the specific facts and details of his subject as to have lost its perspective of the industry as a whole. In the present volume the author, whose reputation is too well known to need any introduction in these columns, not only recapitulates the essential basic facts but quite successfully aims at a presentation of the living industry. Wide in its scope, but exceedingly concise and practical in its treatment of the various departments of the science of artificial color application, this book can be confidently offered to those college graduates who, on commencing their industrial careers, feel themselves literally handicapped by their academic knowledge because of their lack of information on current industrial conditions.

But if many of the pitfalls awaiting the novice are indicated—and the work is an ideal one for the orientation of the "junior member"—it is far from being designed for his exclusive consumption; and, indeed, it is no part of the intention of this department to overemphasize that particular merit, which it undoubtedly possesses, to the obscurement of its usefulness to those actually engaged in the industry—particularly those who have specialized in rather narrow limits, who will find it far more readable than the larger textbooks when they wish to refresh their memories in regard to branches of the subject with which they are not immediately concerned.

In his "General Survey," which opens the book, the author briefly and interestingly traces the manner in which the development of the coal-tar colors, from the discovery of Perkin's Mauve in 1856, has brought about a simplification of the dyeing processes only at the cost of a vastly increased demand for chemical knowledge on the part of the foreman dyer. As an instance of this he cites the development in 1880 of the azoic dyestuffs by Thomas and Robert Holliday, which, by reason of their introduction of an entirely new principle in dyeing—that of making the actual color itself on the fiber—"converted willfully those dyers who used the process into actual color makers, and so demanded from them a knowledge of color chemistry, which had not hitherto been expected of them." Other instances are given chronologically down to the introduction of the vat dyestuffs, which make the biggest demand of all upon the skill and chem-

ical knowledge of the foreman dyer. The author rightly characterizes as "very superficial" the view that modern color firms, with their expert service and assistance, have depreciated the position of the dyer, and calls attention to the fact that all the pattern cards and detailed instructions ever issued will not alone make a dyer.

This work has been prepared, therefore, with a view to giving the reader a firm grasp of the chemical principles involved, and the practical methods used in the application of the coal-tar dyestuffs. Of the many classes of dyestuffs to-day on the market, typical examples only are given to illustrate the principles of their application; complete lists of dyestuffs are purposely omitted in order to avoid making the book appear to be a catalogue of the various dye manufacturers' products. Such lists would only overload the book and create the danger of hiding the essential facts under a mass of non-essential details, and, moreover, such lists soon become out of date. For the same reason no attempt is made to deal with the various types of machines used in the dyeing industry. The choice of a suitable machine is determined by two factors, namely, the class of material to be dyed, and the class of color to be used. The author's experience of seventeen years has taught him, he states, that no single machine will do all classes of work, but that each machine has its defects for certain classes of work. Local conditions must, therefore, largely determine the choice of a machine.

A section on the application of coal-tar dyestuffs in other than the textile industries furnishes an excellent guide to the standard literature on these subjects; there is a discussion of the vegetable and mineral dyestuffs, a section on the valuation and detection of dyestuffs, and another on the dyeing of union materials, including garments. The complete contents comprise:

General Survey of Dyeing, including History, Old Methods, The Influence of the Discovery of Mauve, Gradual Development as New Classes of Dyestuffs Were Introduced, Fast and Loose Dyestuffs, The Present Trend of Dyeing, and The Future Outlook; The Varied Use of Basic Dyestuffs; The Application of the Acid Dyestuffs; The Turkey-Red Industry, and Other Uses of the Alizarine Dyestuffs; The Application of the Direct Cotton Dyestuffs, Including Those Which Develop on the Fiber; The Azo Coloring Matters and Their Special Use in Dyeing; The Properties of the Resorcline Dyestuffs; The Application of the Sulphur Dyestuffs; The Application of the Vat Dyestuffs; The Dyeing of Union Materials, Including Garments; Colors Produced on the Fiber by the Oxidation of Coal Tar Products; Other Uses of Coal Tar Dyestuffs; Dyestuffs Other than Coal Tar Dyestuffs Still in Use, and The Valuation and Detection of Dyestuffs.

This book is uniform with "Coal Tar Dyes and Intermediates," by E. de Barry Barnett, and others of the same series, edited by Samuel Rideal, D.Ss., F.I.C., devoted to industrial chemistry.

Recent Patents

Cloth-Guiding Device for Cloth-Finishing Machines (1,385,746; July 26, 1921)

WILLIAM ALFORD HOGAN

In a device of this character, divergently disposed laterally spaced and relatively adjustable pairs of upper and lower rollers adapted to receive the side portions of a moving cloth web therebetween, and means to positively drive the upper and lower rollers of each pair in a direction adapting the same pull in opposition to the movement of the web.

Process for the Treatment of Vegetable Fibers

(1,384,677; July 12, 1921)

CHARLES SCHWARTZ (assignor to Societe Gillet et Fils, Lyon, Rhone, France)

This is a process for the treatment of vegetable fibers with a view to impart to them the character of wool, both physically, as to feel, appearance and caloric quality, and chemically, as regards their affinity and absorbent capacity for dyestuffs, the process comprising treating the vegetable fiber at the ordinary temperature with concentrated nitric acid and removing the acid by washing.

Machine for Drying Leather, Yarns, Jute and Like Materials

(1,384,359; July 12, 1921)

CHARLES STEPHENS

This is a machine of the type described for sammying and drying leather, and for drying yarns, jute and the like, comprising a long horizontal drying chamber, means for longitudinally traversing the material in forward and return directions through the chamber, an air-pressure inlet duct extending from one end of the chamber, an air-suction outlet duct extending from end to end along the opposite side of the chamber, two flat sets of steam or other coils interposed between the chamber and the suction and pressure ducts respectively, a fan adapted to create a closed continuous circulation of air passing between the coils and through both lines of material in the chamber, and means for continuous extraction of moisture from the closed circulation of air within the chamber.

Air-Moistener

(1,384,702; July 12, 1921)

JOSEPH FRANCIS MALONEY

This is the combination, with an internal combustion engine provided with a fan, and a radiator arranged in front of the fan; of a tubular funnel adapted to receive a blast of air from the fan, this funnel having its lower side inclined downwardly and forwardly,

and provided with an inlet for hot air arising from the engine, a pipe for vapor communicating with the vapor space of the radiator, a fastening device securing the open rear end of the vapor pipe to the lower inclined side of the funnel at its front end so that condensed vapor may drip from the front end of the funnel, and a delivery pipe for moistened and heated air secured to the rear end of the funnel in line with its axis and operatively connected with the fuel intake of the engine.

Machine for Raising Nap on Fabrics

(1,384,920; July 19, 1921)

JULES REGOUT, JR.

This describes a machine for raising nap on fabrics comprising a fixed frame, a traveling carriage movable to and fro on the frame, a plurality of raising rollers and driving means for same mounted in the frame, some of the rollers being adjustable in height, rollers for guiding the fabric through the machine, these rollers being mounted on the traveling carriage, means for deriving the reciprocating motion of the carriage from the driving mechanism for the raising rollers, and means for converting the reciprocating motion of the carriage into a rotary motion for rotating the guiding rollers for the fabric.

Process for the Manufacture of Artificial Threads, Ribbons, Films or Plates from Viscose

(1,386,521; August 2, 1921)

MAX MULLER

Process described of manufacturing artificial threads and other structures from viscose consists in squirting the viscose into a precipitating bath comprising acidified waste lye of sulphite cellulose.

Dressing and Dyeing Moleskins

(1,384,446; July 12, 1921)

HERMAN GABBE

The composition of matter to be used as a dyeing solution for moleskins consists of the following ingredients in about the proportions stated, namely: logwood dye, 50 parts; sal ammoniac, 25 parts; sumac, 25 parts; bluestone, 25 parts, and copperas, 50 parts.

Block Printing Machine for Fabrics

(1,384,934; July 19, 1921)

HENRI GABRIEL EDOUARD AGIER

This device consists of a fabric printing machine having a vertical guide, a follower or carrier reciprocally mounted in said frame, a tilting head fulcrumed for oscillatory movement upon the follower or carrier and carrying a printing block, color distributing means located at one side of the path of movement of the follower or carrier, supply and receiving drums for the fabric, and means for maintaining a prescribed area of the fabric in the path of movement of the printing block.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto

VOL. 9, NO. 14
OCT. 3, 1921

IN 2 SECTIONS
SECTION 2

IN THIS SECTION

In an article on Jute Dyeing, F. C. Holden treats comprehensively of this subject on which so little literature is available. His remarks should prove of particular interest to carpet dyers.

A list of the committees appointed by Professor Olney to effect the organization of the proposed Association of Textile Chemists and Colorists is published.

Abstracts of papers read before the Dye Section of the American Chemical Society are presented.

H. W. Eastman gives practical methods of determining the strength of chlorine bleach liquors in the second of his papers on "The Control of Bleach-House Processes."

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AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incident Thereto

Vol. 9, No. 14

NEW YORK, OCTOBER 3, 1921

Section 2

Jute Dyeing

Dyer Must Treat One Stock or Combination at a Time for Close Matches—Dyeing without Boil for Quick Results—Various Classes of Dyestuffs Employed—Difficulties of Bleaching

By F. C. HOLDEN

Dyer, Chelsea Fiber Mills, Brooklyn, N. Y.

JUTE is generally classed as a vegetable fiber along with cotton, flax and hemp and allied fibers, but its action toward dyestuffs—or rather the action of dyestuffs on jute—is decidedly different from the action of dyestuffs on the aforementioned fibers. Broadly speaking, practically all textile dyestuffs are readily applied to jute direct. There are some exceptions, however, as, for instance, Tartrazine of the acid group, which does not develop a full rich tone as in the case of wool dyeing. Chemically, jute is considerably different from the other prominent vegetable fibers in that it is composed of a compounded form of cellulose known as ligno-cellulose, or bastose; whereas cotton and linen are practically pure cellulose. It is due to this different chemical composition that jute has such an affinity for the several classes of dyestuffs. A simple test to distinguish the presence of jute is immersion in concentrated nitric acid, the jute turning a reddish brown. Cotton and linen turn light yellow. Jute fiber varies in color from a light yellowish tan to a light brown and from a silver gray to a fairly dark gray. It is very essential that the dyer work with one stock or combination at a time, otherwise he will find it difficult to bring out close matches without additions of dyestuff.

Jute finds innumerable uses in the trades, comparatively few of which, however, require a dyed product. The principal use of dyed jute is in the manufacture of carpets, where it is used as face goods for the cheaper lines of carpeting and rugs and as a stuffer or backing and filling for the more expensive grades. It is also used in colors for upholstery work, wall covering, fancy twines, rope markers, shopping bags, jumping rope, horse blankets, coat padding, etc.

WHEN QUICK DYEING IS DESIRED

Jute is generally dyed in the skein form, and since it is not subjected to extremely severe criticism very little preparation for dyeing is required. Where it is to be used as a filling or stuffer yarn for carpets a quick process is most desirable. For this work acid dyes are found to work nicely, as they not only go onto the fiber quickly, but evenly as well. For dyeing on sticks in the open a tub measuring 90 by 26 inches and 28 inches deep will very easily take care of 100-pound lots. The tub is filled to within six inches from the top, the liquor heated to 140 deg Fahr. and 5 per cent of Aluminum Sulphate, 10 per cent Glauber's salt and the necessary dissolved dyestuff added. The dry yarn is then entered, given four turns and three passes and laid up finished. To complete this process only six minutes are required, and two good men will produce thirty-five to forty batches in an eight-hour day. The men will weigh their own yarn, put it on sticks, pass it through the dye liquor, take it off the sticks and deliver it on a truck to the extractor. It is doubtful if the same men could do as much work with a machine of any kind. A standing dye bath is used and the dyer should develop his formulas so that a practical match is produced from the enter. The yarn can be evenly dyed but not thoroughly penetrated by this method.

THOROUGHNESS CALLS FOR BOIL

If a more thorough dyeing and penetration is desired boiling bath is necessary. In this case the liquor is brought to a boil and the salt, alum and dyestuff added. The dry yarn is then entered and given four turns, three

passes and three standing boils. This process requires about thirty minutes and two men can very easily keep three tubs in progressive operation. In this case also a standing bath is used and the formula should be developed to give a practical match from the enter. Since jute is an inexpensive fiber the economic side of the dyeing is of most importance and the dyer cannot give the time to individual matches as is the usual condition in dyeing woolen and worsted, or even cotton skeins. Direct cotton dyes could be used in this boiling process but acid dyes are generally found to be faster to light and their money value greater from a tinctorial point of view. A 500-pound dyeing machine may be used to advantage in this boiling process, as the time required for boiling gives the men an opportunity to unload and refill the frames.

During the past several years bright acid blues and greens have been unobtainable at a price suitable for jute dyeing. It has been the custom to substitute Methylene Blue and Malachite Green of the basic group. To mix basic and acid colors in the same bath the dyer must work with separate dye solutions. Otherwise an insoluble tar-like substance will separate out on the yarn and sides of the tub, giving considerable trouble. The basic colors develop very quickly on jute fiber and an addition of 15 per cent salt to the bath will help to level the dyeing.

CARPET BACKING, ETC.

For very low grade work such as carpet backing, where even dyeing is not strictly essential, an efficient method of handling the work in skein form is by passing the yarn through a skein scouring machine. The liquor is kept close to a boil and constantly fed by a reserve tank, the work being carried out in the same manner that cotton piece goods are dyed in the continuous machine. By this method an enormous production is realized in a very economic manner, acid or direct dyes being most suitable.

Basic black is often used for producing blacks, but acid black is much more sturdy and should be used where fastness to light is considered. For several years Logwood Black has been used, the simple one-bath process being soda ash and bluestone giving satisfactory results. Logwood Black so dyed, however, does not withstand the action of light as well as Acid Black, and with the recent introduction of fairly reasonably priced Acid Blacks, Logwood is being replaced for this purpose.

USE OF POLISHING MACHINES

A certain class of filling yarn known as rug yarn and used as filling for Smyrna rugs, so-called, is commonly dyed on polishing machines. The necessary color; acid, direct or basic dyes; is cooked into a smooth paste with starches, gums and oils. The yarn is passed from spools on a creel through a starch box containing the colored paste, and thence over drying cans. During the drying the yarn is given a brisk rubbing with rope-covered rollers, which produces a smooth finish. This process can hardly be called dyeing, yet with it a great variety of colors may be obtained which fill the requirements even though the color is only coated on the surface.

Jute piece goods are dyed on the jigs, continuous machine, or padding machine. For short runs the jigs are preferable, using acid or direct dyes. For long runs the padding machine gives excellent results. It is advisable to use direct colors for padding, with the addition of a softening oil to the bath. If the padding liquor is held at a firm boil an excellent job of dyeing may be produced. If extremely close woven and hard goods are to be dyed it is sometimes necessary to use the continuous machine for thorough penetration, but generally the padding machine gives satisfactory results.

DIFFICULTY OF BLEACHING

The bleaching of jute is seldom considered except where very bright colors are desired. It is practically impossible to bleach jute to a clear white. The fiber will not withstand the severe treatment that linen or cotton will, and even if it would the cost of handling would probably be too great for the advantage gained. Bleaching, therefore, is carried out in the simplest manner possible. For half bleach the dry yarn is entered into a solution of bleaching powder for one-half hour, washed, scoured and then thoroughly rinsed. The resulting color is a light cream which is suitable as a background for delicate tints. For a full bleach it is advisable to give the yarn a soap and soda wash at a boil, bleach, sour and rinse as before; and finally give a wash in neutral white soap solution at a boil to which the necessary amount of bluing is added. The result is a fair white, which, however, has a decided yellow tint when compared with bleached linen or cotton. Invariably, bleached jute loses 5 to 10 per cent of its tensile strength during the process of bleaching and generally 10 per cent of its weight. It still retains, however, its natural affinity for the several classes of dyestuffs.

Jute can be readily dyed with the sulphur or vat dyes. The requirements of dyed jute are such, however, that the particular properties of fastness of sulphur and vat dyes are not necessary. Certain grades of jute tapestry, sometimes a mixture of cotton and jute, and used for upholstery and draperies, should be fast to light. This class of work is as a rule printed, and if proper dyes are used and afterwards steamed a very fast color is produced.

Standardization and increase of dye industry in Shantung are the aim of the British Ministry of Agriculture and Commerce, which has sent representatives into that province to conduct an investigation. Shantung produces large quantities of blue, red, and yellow dyes which compare favorably with the best coal-tar coloring agents produced in other countries. It is claimed that in some respects they are superior to the coal-tar products. The Ministry believes that some of the Provinces can produce the dyes in larger quantities than are required for Chinese industries. The investigating agent will learn the extent of the vegetable crops from which the dyes are made, and will try to encourage a larger production and more extensive dye industry.

Association of Textile Chemists and Colorists

Definite Organization Now Assured—Inaugural Meeting to Be Held in Boston—
List of Committees Appointed

THE movement for the establishment of an Association of Textile Chemists and Colorists which crystallized at the meeting held at the Chemists' Club, New York, during the week of the Chemical Exposition has gone steadily forward since that time, and present indications are that a large and representative gathering of technical textile men will be present at the inaugural meeting to be held in Boston during the week of the Textile Exposition, October 31 to November 5, inclusive. The place of meeting and the exact dates have not as yet been definitely determined but an early announcement on these points is expected from the committee which has the arrangements in charge.

It will be recalled that at the New York meeting, where about sixty representatives were present, it was unanimously voted that an association be established and that an inaugural meeting to be held at Boston at the time mentioned above. It will be further recalled that Professor Louis A. Olney was elected chairman and directed to appoint suitable committees to take up the various questions in regard to effecting a permanent organization—such committees to report to the Boston meeting.

Acting under this direction Professor Olney has appointed the committees which appear below. Meetings of several of these committees have already been held and others will meet in the near future. The general interest in the proposed association on the part of textile manufacturers as well as all classes of textile technicians is exceeding the expectations of those who were responsible for initiating the movement and any doubt which may have existed in the minds of its sponsors as to the degree of enthusiasm with which the project would be received by the textile fraternity has been definitely dispelled.

The personnel of the various committees follows:

General Organization Committee

Prof. Louis A. Olney, chairman,
Lowell Textile School,
Lowell, Mass.
Walter E. Hadley, secretary,
Chief chemist, Clark Thread Company,
Newark, N. J.
William D. Livermore,
Chief chemist, American Woolen Company,
Lawrence, Mass.
Geo. A. Moran,
Chief chemist, Pacific Mills,
Lawrence, Mass.

Walter M. Scott,
Chief chemist, Cheney Brothers,
South Manchester, Conn.
Wm. R. Moorhouse,
National Aniline & Chemical Company, Inc.,
Boston, Mass.
Robert E. Rose,
Director of Application Laboratory,
E. I. du Pont de Nemours & Co.,
Wilmington, Del.
Wm. H. Cady,
Chief chemist, United States Finishing Company,
Providence, R. I.
Frederic Dannerth,
Textile Trade Laboratory,
Newark, N. J.
A. E. Hirst,
Chief chemist and assistant superintendent,
American Printing Company,
Fall River, Mass.

Special Committees

COMMITTEE ON INAUGURAL MEETING, PROGRAM AND NOMINATIONS

Winthrop C. Durfee, chairman,
Consulting and Manufacturing Chemist,
Boston, Mass.
Wm. R. Moorhouse,
Russell W. Hook,
Textile chemist, A. D. Little & Co., Inc.,
Cambridge, Mass.
Walter S. Williams,
Chemical engineer, Mt. Hope Finishing Company,
North Dighton, Mass.
Harry R. Davies,
I. Levinstein & Co.,
Boston, Mass.

COMMITTEE ON BY-LAWS

Wm. D. Livermore, chairman.
Geo. A. Moran.
Warren H. Whitehill,
Chemist, Brightwood Manufacturing Company,
North Andover, Mass.
John F. Panan,
Chemist, M. T. Stevens & Sons Company,
North Andover, Mass.
Hugh Christison,
Chief chemist, Arlington Mills,
Lawrence, Mass.

COMMITTEE ON MEMBERSHIP

Harold W. Leitch, chairman,
Chemical engineer, M. T. Stevens & Sons Company
Franklin, N. H.
Elmer C. Bertolet,
Prof. Textile Chemistry, Philadelphia Textile School,
Philadelphia, Pa.
Frederic Dannerth.

COMMITTEE ON PUBLICITY AND PUBLICATIONS

E. H. Killheffer, chairman,
Newport Chemical Works, Inc.
Passaic, N. J.
Walter E. Hadley.
Frank C. Holden,
Chemist and dyer, Chelsea Fiber Mills,
Brooklyn, N. Y.

The Control of Bleach-House Processes

Determination of the Strength of Chlorine Bleach Liquors

By H. W. EASTMAN

FOR many years it has been customary, in the majority of bleach houses, to prepare chlorine bleach baths, based upon the strength indicated by means of a Twaddell hydrometer. If ideal conditions did but prevail in bleach houses this method might not be so ill-suited to such a control, but when any thought is given to this matter it is easy to understand why such a method of establishing the strength of the chlorine bleach must, of necessity, be unreliable.

The Twaddell hydrometer is an instrument for registering the specific gravity of liquids, and therefore any substance whatsoever, contained in a liquid, which increases its density shows a certain definite value as expressed on the Twaddell hydrometer.

Bleaching powder is prepared by passing chlorine gas over freshly slaked lime, whereby varying amounts of chlorine are absorbed. An average good grade of bleaching powder contains 35.5 per cent, and at times as high as 40 per cent, available chlorine. The quality of bleaching powder also varies as to whether a "lean" or "fat" lime has been used in its preparation.

Unfortunately, bleaching powder deteriorates more or less rapidly, and at times bleaching powder which has lost a large percentage of its available chlorine is received by the consumer. Instead of a dry powder containing its full value of absorbed chlorine gas, the mass has lost chlorine and absorbed moisture, and is in a more or less pasty condition.

If bleaching powder is used for bleaching cotton material, only the better grades should be accepted—i. e., those containing approximately 35.5 per cent available chlorine and prepared from a "fat" lime containing but little silica and iron. After grinding and mixing with water, the settling should be such that the sludge is compact while the supernatant liquor is clear and free from suspended matter.

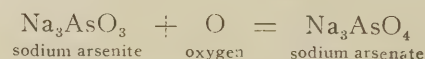
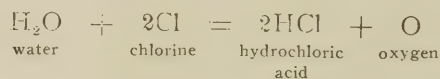
Within the past few years the use of liquid chlorine has found favor and, in many instances, has replaced bleaching powder.

The value of a bleach liquor, prepared from either

bleaching powder or liquid chlorine, depends upon the amount of available chlorine present in the solution. It is the object of this paper to present, in a simple and concise manner, a method by which the strength of the stock bath, as well as that of the liquor in the bleach vats, may be perfectly controlled.

METHOD OF BATH CONTROL

This method is based upon the principle of the oxidation of arsenous oxide to arsenic oxide, such oxidation being induced by the presence of chlorine.



This method indicates only the chlorine available for actual bleaching, and does not include the chlorine present as chlorates, chlorides, etc., which possess no bleaching value.

An outline of the method of control is as follows: Five cubic centimeters of strong stock liquor, or 25 c.c. of the exhaust bath, is placed in a small beaker, diluted with 25 c.c. of water, and tenth normal sodium arsenite is carefully added from a burette until a drop of the well-mixed solution no longer produces a blue coloration when touched to a piece of filter paper saturated with potassium-iodide-starch mixture.

PREPARATION OF TEST SOLUTIONS

Tenth normal sodium arsenite solution may be prepared by adding 4.95 grams of pure arsenious oxide (As_2O_3) and 25 grams pure sodium carbonate to about 250 c.c. water, and heating to a boil to bring same into solution. After the solution is clear, cool and dilute to 1,000 c.c. with water.

The potassium-iodide-starch indicator may be prepared by dissolving $\frac{1}{4}$ gram of soluble starch in 50 c.c. of water containing $\frac{1}{4}$ gram potassium iodide.

INSTRUCTIONS FOR USE OF CONTROL TABLE

The accompanying control table is formulated as follows: The upper section shows the strength of the stock chlorine liquor, expressed in grams of chlorine (Cl_2) per gallon. The Twaddell readings are based upon solution prepared with bleaching powder containing 35.5 per cent available chlorine. The lower section is dependent upon the strength of the stock liquor, and shows the number of gallons of same necessary to prepare 1,000 gallons of 1 deg. Tw. bleach bath or to replenish to 1 deg. Tw. 1,000 gallons of an exhaust bleach bath.

CONTROL TABLE

5 c.c. of stock liquor requires c.c. sodium arsenite—	Gm. Available Chlorine per Gal. Stock Liquor						
	5.00	5.50	6.00	6.50	7.00	7.50	8.00 Tw.
20.30	55	...	...	...	...	...	...
22.34	60	...	...	...	...	...	...
24.39 .....	...	66	...	...	...	...	...
26.60 .....	...	...	72	...	...	...	...
28.82 .....	...	...	...	77	...	...	...
31.12 .....	...	...	...	...	84	...	...
33.41 .....	...	...	...	...	...	90	...

25 c.c. solution from bleach bath requires c.c. sodium arsenite—	Gm. Available Chlorine per Gal. Stock Liquor						
	55	60	66	72	77	84	90
Gallons of Stock Liquor Required to Produce 1,000 Gal. Bleach Solution (1 deg. Tw.)							
0	189	170	156	143	132	122	114
1	170	160	140	130	121	112	104
3	156	142	131	119	108	100	93
5	137	130	120	110	94	87	81
7	117	106	98	89	81	75	69
9	98	89	81	75	67	62	58
11	78	71	65	59	56	50	46
13	59	53	48	45	40	37	34
15	39	35	32	29	27	24	23
17	19	17	16	14	13	12	11
19	0	0	0	0	0	0	0

Example: If a new bleach bath is to be prepared and a volume of 1,000 gallons of liquor is required, proceed as follows:

DETERMINATION OF STRENGTH OF STOCK BLEACH LIQUOR

1. Withdraw 5 c.c. of stock liquor, place in beaker, and titrate with sodium arsenite solution, noting the number of cubic centimeters required. If 20.3 c.c. is required, then by reference to control table it will be seen that 55 grams of available chlorine is contained in each gallon of stock liquor.

2. Follow down, in same column, to lower section of control table and read opposite 0 cubic centimeters: it will be found that 189 gallons of strong stock liquor, containing 55 grams of available chlorine, will upon dilution to 1,000 gallons with water produce a true 1 deg. Tw. bleaching powder solution. By the same reasoning, it will be seen that the figures opposite 0 cubic centimeters in each succeeding column show the number of gallons of stock liquor, of varying strength,

required to produce 1,000 gallons of a freshly prepared 1 deg. Tw. bleach liquor.

If a used bleach bath is to be replenished to proper strength proceed as follows:

Determine strength of strong stock liquor as shown under 1.

2. Withdraw 25 c.c. of the exhaust liquor, place in a beaker, and titrate with sodium arsenite solution, recording the number of cubic centimeters required.

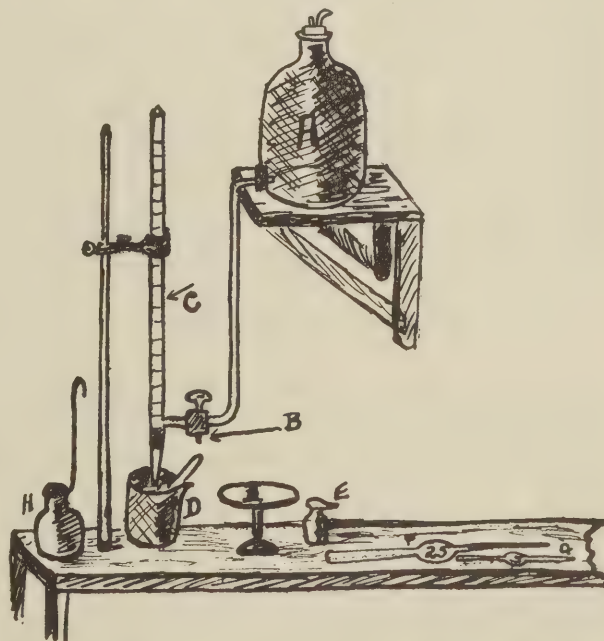
The column at the extreme left, in the lower section of the control table, shows varying volumes from 0 to 19 c.c.

If 19 c.c. of sodium arsenite is required to completely react with the liquor, then the succeeding columns each show 0, indicating that the bath is full strength and requires no further addition of stock liquor. If, however, only 13 c.c. were required, then each succeeding column, opposite 13, shows the number of gallons of varying strengths of stock liquor required to replenish a bath to 1 deg. Tw. upon dilution to 1,000 gallons with water.

The control table could be easily elaborated to include volumes of liquor other than 1,000 gallons.

This method of procedure has been found to yield excellent results under practical conditions, and positive reliance can at all times be had as to the chlorine strength of the bleach bath.

The cut shown herewith illustrates a very satisfactory set of apparatus for use in the control work.



A—Half-gallon stock bottle of tenth normal arsenite solution.
B—Stopcock at rubber connection between A and C for automatically filling burette.

C—Twenty-five cubic centimeter rubber-tipped burette.

D—Beaker for titration.

E—Dropping bottle for potassium-iodide-starch solution.

F—Twenty-five cubic centimeter pipette.

G—Five cubic centimeter pipette.

H—Pint bottle, with handle, for sampling.

I—Circular stand for holding potassium-iodide-starch test paper.

Abstracts of A.C.S. Dye Division Papers, Fall Meeting

THE September meeting of the American Chemical Society, held with the New York Section during the week preceding the Chemical Exposition, was marked by one of the most successful gatherings of the Society's Division of Dye Chemistry yet recorded. In all, some twenty papers were presented dealing with various problems associated with the application and manufacture of dyes and intermediates, and the character of these papers was such as to produce many interesting and valuable contributions to literature of this class.

The Dye Division meetings took place Thursday and Friday of the week devoted to the general conclave, and were held in the Mines Building, Columbia University, which institution gave a reception in honor of the visiting British, Canadian and American chemists. Officers of the Dye Division elected to serve throughout the coming year consisted of: Chairman, W. J. Hale, who succeeded A. B. Davis; vice-chairman, Louis A. Olney, and secretary-treasurer, R. Norris Shreve. The executive committee consists of B. A. Ludwig and Robert E. Rose.

Particularly interesting among the non-technical papers was that of Dr. Gaston Dubois, who gave a well-prepared discussion of depreciation, obsolescence and general burden charges in the dye industry, reminding the assembled chemists that these important matters should receive their close consideration instead of being left solely for the attention of cost accountants. The first paper on the program was "The Dye Situation in Canada," by W. F. Precsott, which appears in the current issue of The REPORTER's Weekly News Section.

Prof. Louis A. Olney's paper, "Extraction Process for Degreasing Wool," will be printed in full in the Technical Section for November.

Abstracts of the various papers follow:

CONTRIBUTION TO THE CHEMISTRY OF CYANXANTHEN AND CYAN ACRIDINIUM DYES—George Hcyl—In the course of researches undertaken with a view of introducing into the acridinium molecule other groups to render the dye more toxic toward certain pathogenic organisms, it was found that a number of new dyes can be produced heretofore not recorded in the literature:

1. Xanthen group, starting material: Pyronin G. This dye by treating it in aqueous solution with KCN, a leuco derivative was formed, identified as tetramethyl diamido-ms-cyanxanthen, which on oxidation with ferric chloride, etc., could be converted into a blue dye, a cyanpyronin which is similar in shade to Capri Blue. Structural development of the cyan dye is given.

By a similar method a number of other new dyes, belonging to the acridine series, were obtained.

2. Acridine group: Starting material: 3-6-Diamido-N-

methyl acridinium chloride (acriflavine) a yellow dye of antiseptic properties. By treatment with KCN was converted into 3-6-Diamido-N-methyl-ms-cyan-acridan, a colorless substance which on treatment with oxidizing agents is converted into a new dye: Cyan-acriflavine, a red dye of safranin shade.

From Ullman's Acridinium Yellow there was obtained a brilliant violet cyan dye and from Acridinium Orange a pink one.

3. The reduction derivatives of these dyes (cyan dyes) are interesting inasmuch as they again yield new dyes each differing in shade from the mother dye. The red cyan-acriflavine on reduction with Zn and HCl is converted into a "double-acriflavine," an orange dye of great stability to alkalis.

LAKES FROM PHENETIDIN—J. C. Schmidt—Phenetidin and derivatives when diazotized and coupled with Beta-Naphthol or R Salt form colors that range in shade from an orange to scarlet and to deep maroon. Some of these pigments are soluble; others insoluble in oils. These colors are remarkable for fastness to light and brilliancy, rivaling those produced from Alizarine. Their qualities make them valuable for the manufacture of Lakes for printing ink, and painting purposes, varnish stains, coloring waxes and paraffin, also for printing textiles.

THE SYNTHESIS OF ANTHRAQUINONE FROM PHTHALIC ANHYDRIDE AND BENZENE—E. R. Harding—The Friedel Crafts reaction for the preparation of ortho benzoyl benzoic acid was studied extensively. Phthalic anhydride reacts with benzene and aluminum chloride to give an unstable intermediate compound which is easily decomposed to give a salt of benzoyl benzoic acid. This acid is readily converted to anthraquinone by heating with sulphuric acid. The yields throughout are good. The process is commercially attractive because the raw materials are abundant and comparatively low priced. Anthraquinone produced from anthracene so far has been expensive on account of the cost of anthracene, the removal of which from tar leaves a pitch of low value.

A DIRECT READING SPECTROPHOTOMETER FOR MEASURING THE TRANSMISSIVITY OF LIQUIDS—Irwin G. Priest, National Bureau of Standards—This instrument has been designed to provide means for rapid and convenient as well as accurate work, particularly in the technologic examination of dye solutions and oils. It consists essentially of a combination of a constant deviation wave-length spectrometer and the author's "exponential" or "variation of thickness" photometer.

Wave-length and transmissive index ("extinction coefficient") are both read *directly* from the instrument scales without any computation. The instrument will be fully described in a forthcoming Bureau of Standards publication to which reference should be made for details. Interested persons may have their names placed upon the mailing list for this paper by addressing the Bureau of Standards, Div. IV, Sec. 3, Washington, D. C.

NAPHTHALENE SULPHONIC ACIDS. IV. THE SOLUBILITIES OF SOME AMINO SALTS OF NAPHTHALENE SULPHONIC ACIDS—H. Wales—Solubilities of the salts of alpha and beta naphthylamine with some naphthalene sulphononic acids have been determined between 25 and 98 deg. Cent. Allotropic changes are indicated for two of the salts and an interesting relation between the solubility and structure of a series of isomers is shown.

THE PREPARATION OF ALPHA GAMMA QUINOLINES. I. 2, 4 DIMETHYL, 6 ETHOXY QUINOLINE: AN IMPROVED METHOD FOR ITS PREPARATION AND A STUDY OF THE CONDENSATION—S. Palkin and M. Harris—A study has been made of the conditions affecting the yield and quality of 2,4 dimethyl, 6 ethoxy quinoline as prepared by the Beyer (Pfitzinger) synthesis for alpha gamma quinolines. Tolerance toward water and temperature variation and effect of oxidation in the synthesis; also relative effectiveness of purification reactions introduced by Mikeska for the recovery of pure base have been investigated. Boiling range curves (at 30 mm.) for the base at different stages of purification have been worked out.

One of the principal difficulties incident to the recovery of the base from the reaction mixture, has been overcome by the application of a steam treatment rendering possible the elimination of tedious extractions or steam distillations.

An improved process (depending on the Beyer-Pfitzinger synthesis) for 2, 4 dimethyl, 6 ethoxy quinoline, is described, which is much simpler of manipulation, requires less time to carry out, is adaptable to larger scale operation, and yields 10 to 15 per cent more pure base than by the former method.

INCREASING THE YIELD OF OUR DYES—J. L. Bullock—The first consideration is thorough knowledge of the intermediates. Tests for quality are essential as small amounts of impurity have a decided effect on the yield. Specialization on few dyes is necessary in order to know them thoroughly. The best intermediates obtainable are usually the cheapest in that they give greatly increased yields. The sedimentation of solutions is advantageous and filtration at every stage adds to tinctorial power of the subsequent dye. In actual synthesis of dyes intelligent use of equipment is as essential as chemical control. Uniformity in carrying out reactions is a great factor in obtaining maximum yields. Diazotizations should be as rapid as possible. Coupling a different con-

densation; they form a good indication of its course. It is important to precipitate the dye in an easily filterable state. With triphenylmethane dyes even greater care must be used than with the azo dyes. A knowledge of the dyeing properties, fastness, etc., is very useful in getting the standard of purity to the highest possible point. Attention to the most minute details is repaid by increased tinctorial power and lessened cost of the finished dye.

THE PREPARATION IN THE PURE STATE OF CERTAIN DYES OF THE MALACHITE GREEN SERIES—Walter A. Jacobs and Michael Heidelberger (Laboratories of the Rockefeller Institute for Medical Research)—It is shown that in many cases in which the chlorides are too soluble or do not crystallize, the nitrates may advantageously be used for isolation of the dyes. Descriptions are given on this basis of salts of Malachite Green and some of its methyl, halogen, amino, acylamino, alkylamino, hydroxy and alkoxy derivatives, as well as the nitrate of brilliant green, and the furfural analog of malachite green.

THE ELECTROMETRIC TITRATION OF AZO DYES—D. O. Jones—The titanous chloride reduction methods originally suggested by Knecht for the analysis of numerous compounds both organic and inorganic, have, in recent years, come into more general use in the field of dye chemistry. The titanous chloride method for the analysis of azo dyes becomes more generally applicable, when the end point of the titration is determined by the electrometric method. The method in general is similar to the usual oxidimetric analysis as carried out with the electrometric apparatus. In the former methods, employing the use of a sulphocyanide indicator, the end point in the back titration with ferric alum is sometimes difficult to determine. Dark colored material in suspension and the color which is sometimes imparted to the solution by the products of reduction do not interfere in the electrometric method. It also permits the use of larger samples, while the end point is readily and accurately obtained.

EXTRACTION PROCESS FOR DEGREASING WOOL—L. A. Olney—This paper will be presented in full in the November Technical Section of The Reporter.

FASTNESS TO STORAGE—Oscar R. Flynn—Dyed cotton goods sometimes change unevenly when stored in the folded piece. Regions of change mark out the channels along which air flows due to the changes in temperature. This shows that the change in the dye is caused by some substance present in the air in small quantity and not primarily to oxidation, which shows its effect in the interior of a mass of goods. In some cases the change is temporary, and the result of the action of acid alone. In other cases the effect is due in the first place to acid, but followed later by complete destruction of the dye. Alkali sensitive dyes such as Stilbene Yellow show temporary changes due to acid alone. Acid sensitive dyes, such as Congo Red, show permanent

change due to fading after actions of acid. When alkalis are used in finishing, enough should be used to last a year or more. Alkali sensitive dyes should be finished in the acid condition. Dyes fast to acid and alkali are safest.

DYE COSTS—*Gaston Dubois*—The domestic dye manufacturers are unable to-day to meet German competition because their costs are too high, and for that reason we are rapidly losing our foreign trade in dyes. Contributing to the high costs are such factors as depreciation, obsolescence, idle plant costs, insurance and taxes, which are not usually appreciated by dye chemists. We also have a great deal of duplication in our industry, which further adds to these indirect costs. Production costs are two to three times what they are in Germany. This is due, partly, to higher wages and salaries, less volume production, and inferior yields. We have gone ahead producing new dyes and intermediates without considering what our competitors are doing and without appreciating the needs of the market. Shall we organize our industries so as to eliminate duplication of effort?

THE EFFECT OF DYE STRUCTURE ON DYE ADSORPTION—*Leon W. Parsons and W. A. McKim*—Some preliminary results which were obtained during the course of an extended investigation now being conducted on the relation between the structure of dyes and their adsorption constants are discussed. Data has been obtained regarding the constants of adsorption in the case of the following water-soluble dyes when equilibrated with wool at constant temperature: Picric acid, Eosin, Erythrosine, Brilliant Green, Malachite Green, Ponceau 2G, Ponceau 4GB, Chromotrope 2R, and Chromotrope 2B. In all cases, the equilibrium points obtained are found to be well represented by the Freundlich adsorption equation. A close similarity in structure between dyes within a certain chromophoric classification gives practically the same value for $1/n$, one of the Freundlich constants, whereas a wider difference in structure is accompanied by a corresponding tendency toward divergence in the value of $1/n$. Some interesting results have been obtained regarding the effect on adsorption of loading the pure dyes with various amounts of sodium sulphate. A discussion is given of the factors involved.

PREPARATION OF AMINO-PHENOL-SULPHONIC ACID BY THE CHLORO-BENZENE METHOD—*J. R. Minevitch*—Amino-phenol-sulphonic acid (2:1:4) is best prepared by reducing the corresponding nitro-phenol-sulphonic acid with either acid or alkali reducing agents, depending upon the medium in which the nitro body is last obtained. A successful manufacturing process would, therefore, largely be based upon the ease with and small cost at which the nitro compound can be produced in large quantities. There are four other possible methods for its manufacture, but

the chlorobenzene process gives the highest yield and at a vastly cheaper cost. The paper consists of a discussion of experimental results and gives directions for preparation.

THE FUTURE OF RESEARCH IN THE DYE INDUSTRY—*M. L. Crossley*—Research is of vital importance to the dye industry. To correctly evaluate and wisely apply the fundamental facts of science in the solution of complex industrial problems, men must be carefully selected and thoroughly trained. The selection must be done during the training period and not during the productive period. It is of the utmost importance that only those giving promise of research ability and possessing the capacity for the development of the spirit of research should be selected. To depend upon "the law of the survival of the fittest" to eliminate the unfit is economically wasteful and dangerous. A grave responsibility rests upon our educational institutions for the selection and training of men to direct and carry on the future activities of our industries. The training for research must be thorough. Herein our system of education is weak. Serious thought must be given to the correction of this defect if we are to excel in scientific endeavor. Our system of education must secure greater concentration and tenacity of purpose without sacrificing any of the dynamic spontaneity of the individual. Greater appreciation of the contribution of research to the progress of industry must be had before research will be correctly evaluated. The compensation of the research man must be commensurate with his service to the industry if the best men are to be encouraged to serve in this field. The future of the dye industry in this country will depend upon our ability to develop able research men and upon our willingness adequately to appreciate the contribution of research to the progress of the industry.

THE QUALITATIVE AND QUANTITATIVE EVALUATION OF DYESTUFFS—*Robert E. Rose*—Determining the value of dyestuffs is an art as complex as that of the gem expert. The dye tester must compare different colors so closely that he is able to tell the differences produced by $1/32$ of an ounce of color in 100 pounds of material. He must do this on a little sample weighing from $1/14$ to $1/3$ of an ounce; that is, he actually sees the difference produced by adding or subtracting one ten-millionth of an ounce of that dyestuff in the field of vision. In the matter of shade he must be more particular than the most stylish woman. He must check one lot of dyes against another and not pass any two that vary perceptibly to the ordinary eye. If asked to do so, he must be ready to match colors just as exactly. All this he does by very careful observation and very precise weighing of the quantity he uses—even his light has to be exactly used. American dyes are better standardized than German ones ever were, thanks to the American testers.

RESIST

By Charles A. Everett, B.T.C.

Chemist, North Berwick Co., North Berwick, Me.

THERE have been a number of mills which, during the past two years, have experienced considerable trouble in piece dyeing from a spot or stain, called "resist," which acid dyestuffs, with the exception of blacks, will not cover.

The writer has been fortunate enough to overcome some of the difficulties encountered in eliminating the causes and making unmerchantable goods marketable.

One successful mill in question has had to resort to carbonizing after coloring where acid dyestuffs are employed, but has found it possible to carbonize previous to coloring with the use of chrome bottom colors. When the "after-carbonizing" method is used the shades should be left on the "full" side to eliminate toning up after neutralizing.

CONCENTRATION OF ACID

The strength of the acid in the carbonizing tank is of the utmost importance and should be watched closely. During the winter months it has been found safe to run the acid as high as 3 deg. Be. As the weather warms up in the spring the acid should be gradually reduced, until in extremely hot weather it should be as low as 1½ or even 1 deg. Be. It must be borne in mind that reference is made only to cases where the overseer feels he can resort to the "before-carbonizing" method with apparent safety.

SPECIAL ATTENTION TO HYDRO EXTRACTION

The pieces, after running through squeeze rolls to get rid of a large part of the acid, should not lie in the box any great length of time before being extracted. After the extractor has attained its maximum speed it should run from fifteen to twenty minutes, or until there is no more liquor to be removed. Before the pieces are removed from the extractor the inside rim of the basket and the top of the shell should be wiped dry to remove spots of acid that settle there after flying from the basket as it is attaining its speed. Goods ready for the dryer should be removed from the vicinity of the extractor, as the acid spray from same will cause trouble.

Good results have been obtained where the speed of the dryer has been regulated to accommodate one 50-yard cut approximately every fifteen minutes, and the temperature kept just high enough to thoroughly dry the pieces before they enter the baker. The dryer should be well ventilated, as it is a well-known fact that an ill-ventilated dryer will not only cause resist, but the gases have been responsible for streaky and cloudy goods.

The ventilation of the baker is not as important as the dryer, but it should not be neglected. The temperature of the baker should never be lower than 220 deg. Fahr. The steam pipes in the baker should be

examined frequently, as steam or water coming in contact with the cloth in the baker will cause resist.

The cloth in the dryer and baker must be kept open width, for if it is allowed to roll it will not be dry on entering the baker and the stains will be formed immediately.

All metallic parts of the carbonizing tank that come in contact with the goods should be well covered with shellac. The iron tie-rods of the tank should be enclosed in a lead pipe to prevent the formation of sulphate of iron. The extractor shell and basket, dryer and baker rolls, and all other parts of the equipment where the cloth in the acid condition strikes should be well shellacked.

It must be borne in mind that acid piece dyes that have not been carbonized and must be returned to the dyehouse to be reboiled for streakiness, shaded up, or for some other cause, should be given this operation before carbonizing. It is presumed where mention is made of the above that one piece of each set is dried and perched after coloring and before carbonizing, so that streaky pieces can be returned to the dyehouse to be reboiled.

Some mills have experienced trouble in the dye kettles, both on carbonized and uncarbonized goods, the trouble finally being located in the feed box—that is, the steam striking directly on the goods.

To cover acid colors which show resisted places the following formulae have worked admirably:

Strip the greater part of the color from the pieces with 2½ to 3 per cent ammonia at a boil, and wash off thoroughly. Boil the pieces one and one-quarter hours in 3 per cent bichromate of soda, 3 per cent cream of tartar and 1½ per cent copper sulphate, and wash off. Then dye with 2 per cent hematine crystals and 1 per cent of a blue black that dyes on a chrome bottom, for one hour, without Glauber's salt or acid, and wash off. This leaves a reddish hue that can easily be overcome with ¼ to ½ per cent Wool Green S and 1 to 3 per cent of an acid blue of a greenish cast, using 10 per cent Glauber's salt and 5 to 10 per cent acetic acid. This will cover the stains, giving a good navy shade, and thereby make the goods merchantable.

If the goods can be put into black, boil them for one to one and one-half hours in 3 to 6 per cent of Naphthylamine Black 10B, using 10 per cent of Glauber's salt and 5 to 10 per cent acetic acid, and wash off.

IMPORTANT POINTS TO REMEMBER

Keep acid in carbonizing tank as low as possible.

Have all metal parts in pickle tank extractor and dryers carefully shellacked.

Keep heat in dryer as low as possible, acting judiciously regarding ventilation.

Keep carbonized goods from sunlight until neutralized.

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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GRATIFYING PROGRESS

FROM the standpoint of those who are actively working to achieve the organization of an Association of American textile chemists and colorists, as well as those whose interest in the endeavor has not yet advanced beyond the point of very real but unexpressed approval, events of the most encouraging character have transpired during the month just ended.

Not only did the movement assume tangible form when the preliminary meeting held in New York unanimously declared in favor of organizing and voted to appoint committees to present a tentative program next month in Boston, but the enthusiasm of the sixty who attended exceeded even the expectations of the committee which issued the invitation, while letters and telegrams expressing regret at inability to attend and signifying support and approved still further testified to the favor with which the plan is regarded.

Members of the Dye Section of the American Chemical Society have asserted their belief that the two bodies will aid rather than antagonize one another, the prosecution of several projects of the Dye Section is being delayed in the expectation of co-operatively attacking them with the new body, the various committees are preparing to submit an organization scheme next month and, in short, the creation of the proposed Institute now seems reasonably assured.

The AMERICAN DYESTUFF REPORTER has watched these developments with the keenest interest and the most sincere gratification, and takes this opportunity to felicitate the American textile industry upon the progress which has been made toward the accomplishment of something of positive benefit, not alone to the textile chemists themselves, but to every branch of the industry. The only wonder is that mill owners and others financially interested had not long since preached co-operation on the part of their chemists and colorists, for both par-

ties will be gainers and the need has stood forth with compelling distinctness in the eyes of all who cared to see.

Elsewhere in this issue will be found an announcement of the personnel of the committees appointed to report at the Boston meeting, together with an account of what progress has already been made. The question of eligibility to membership in the association will not be decided until the Committee on Membership has presented and secured acceptance of its report. The feeling generally prevails, however, that active membership should be restricted to textile chemists and those actually engaged in the application of dyes—which is to be interpreted as not alone including dyers, textile printers, bleachers and finishers, but also the technical men associated with the dye manufacturing companies whose chief concern is with the application of dyes rather than their manufacture.

It is probable that when the Organization Committee makes its report, it will be found that its members will have endeavored to incorporate into the new association the most desirable features of a number of the most successful technical organizations in this country and abroad—another earnest of success, for the technical association is not an experiment; it has conclusively demonstrated its practicability, and the projected addition to its ranks will possess a very real advantage in being thus able to select many features of proven worth.

Yet all these are still being weighed, and hence we wish to call attention to the fact that the chairman of the committee will welcome suggestions from all who are interested, in order that every phase of the situation may be given careful consideration prior to the inaugural meeting. We urge such to write him, offering counsel if they desire, to the end that those in charge of organization plans may receive the fullest expression of opinion and therefrom strike an average. Also we urge that all who can possibly do so will make arrangements to attend the meeting to be held next month during the progress of the Textile Exposition in Boston, for it is the duty of the textile chemical fraternity to see that this gathering be made a truly representative one.

A FLYER IN COMMUNISM

THE news that several thousand workers in the Hoechst Aniline Works, Germany, have formed a Soviet, seized the huge plant, driven out the directors and placed a guard around the premises to prevent their return, is most interesting and will be received with amazement by some, with doubt by others and with close attention by all.

The occasion was a threatened lockout; the causes reach further back. Some time ago the men asked for wage increases and were refused. They then entered the offices of the company, mobbed the directors and nearly killed one of them, and forced others to sign a previously prepared wage increase contract. In retaliation, the officials subsequently let slip no opportunity to oppress their employees, thereby breeding a dangerous

spirit which, fed by Soviet propaganda, was to culminate in the violent scenes which brought about their overthrow. Not long before the seizure of the plant, the company succeeded in forcing the men to retract on the enforced wage increase agreement, and even then the final step might possibly have been averted through the arbitration efforts of President Ebert and the District Governor, had it not been, indirectly, for the Badische explosion.

The appalling losses and the frightful suddenness of this disaster completely demoralized the men, and awakened in them a keener realization of the hazards to which they were themselves perpetually exposed. They contended that they were entitled to higher pay because of the personal risk factor in their calling, if for no other reason, and when this was again refused and a lockout threatened, law, order and inherent discipline went by the board with the result that the red flag bearing the Soviet emblem was, at last report, flying over the Hoechst works.

Throughout Germany's industrial history, her great strength has lain in her organization, her unsurpassed ability to co-ordinate, train and drill large numbers of persons to do the same thing efficiently and well. Her utilization of scientific principles for the study and conquest of every merchandising problem, and her uncanny ability to hypnotize each individual into a perfectly wrought cog for the gigantic manufacturing and selling machine, brought her fortune where dependence on weak creative ability would have brought but failure, or at best indifferent success. Germany has never been a pioneer in chemistry, for instance, but in its commercial application she takes front rank. Organization has done it. From the time of his earliest understanding, the German workman is trained to think in the terms of national, rather than individual, welfare. This doctrine, in his case, is almost, so to speak, bred in the bone—if not actually hereditary.

To see this training, then, give way so precipitately be-

fore the encroachments of Soviet thought and example, would indeed be somewhat staggering were it not for the fact that one expects a great war to bring in its wake all sorts of topsy-turvy situations. And while the underlying spirit of unrest is no doubt as prevalent in Germany as it remains elsewhere, there is no reason to suppose that the present disturbance is more than local, nor that the German coal-tar combine is disintegrating. It has experienced two great shocks in as many weeks, but its resources have not even begun to be taxed as yet. Moreover, the seizure of the plant by these workmen is no more serious a menace to Germany's industrial life than the similar outbreak which Italy experienced and has since got bravely over. Hence, certain of our Congressmen may rest assured that the need for protecting the American dye industry has not been diminished one whit by this little flyer in Communism within the stronghold of the Cartel.

DYE STANDARDIZATION

C. R. DeLong, chief chemist to the Tariff Commission, asks in the name of that body for the co-operation of dye manufacturers and whatever technical organizations may care to assist in standardizing the classification and nomenclature of dyes. In an address before the Dye Division of the A. C. S. he called attention to the increasing number of dyes which cannot be identified by the Schultz tables, as well as the great variety of names applying to dyes of the same constitution. Promising the aid of the Tariff body, he then declared that such a revision would eliminate much of the mystery in the minds of consumers, and would likewise demonstrate that the domestic industry is not to follow the pre-war methods of the Germans in the sale of dyes. For this reason alone, if for no other, the Tariff Commission should receive this co-operation, and the project is one in which the proposed organization of textile chemists and colorists might most logically participate.

The Production of Bleached Cotton Goods with Colored Borders

Work of the Chemist—Tests for Resistance to Hypochlorites, Acids and Soap—Resistance of Various Colors—Processes Recommended—Work of Bleacher—Alkalies and Hypochlorites—
Aftertreatments with Various Agents—Hydrogen Peroxide—Malt—
Chemist's Control of Bleaching Operations

By RAFFAELE SANSONE

THE production of bleached goods with colored borders has developed quite extensively during the past decade, and is at present conducted nearly everywhere with more or less success or profit. In order to obtain the very best and most valuable effects, however, the operation has to be conducted under special conditions, and the bleacher cannot always be in a posi-

tion to apply these, because his works may not be producing the goods treated, because of having to turn out a large production in a short time, or because of not having at his disposal the necessary plant for the treatment of certain goods. Moreover, it may be necessary to change the treatment of the goods from time to time, and sometimes even from case to case, in order to avoid

misfortune and the production of inferior goods or to avoid too weak a treatment in those instances where it is possible to obtain the desired effects through the ordinary process of boiling out and hypochlorite bleaching employed in most works, and thus eliminate the extra expense of a special treatment more adapted to a different class of goods.

DIFFERENT CLASSES OF GOODS

Depending upon the different uses to which the goods with the colored borders are put, or in accordance with the class of goods to be produced, the colors used may have little fastness to washing and light or may require great fastness to washing and light, and, in some cases, even great fastness to hypochlorites (certain towelry, drying gowns, bed covers, tablecloths, blind cloths, etc.). For these reasons the treatment of cotton fabrics of the above nature is often quite a difficult task, especially if their colored borders have not been obtained with dyestuffs having sufficient fastness for resisting without bleeding or fading to the boiling-out process with carbonate of soda, lime or silicate of soda usually adopted, or to the treatments with hypochlorite of soda or hypochlorite of lime, and the treatments with acid and soap which follow.

The bleacher, if aided by a good chemist or colorist, can successfully accomplish such a process, especially if he lets the latter investigate matters before risking any work on a large scale. For the purpose of aiding matters as much as possible he could bring to the laboratory a yard sample of each bath of cloth to be treated, containing as much as possible of the colored border, asking the chemist or colorist to investigate what bleaching process is best adapted to the colors present in the borders, and asking him whenever necessary to make reports of control during the different phases of the bleaching process adopted.

THE CHEMIST'S WORK

Once the chemist has received his samples from the works he compares these with samples of older batches treated at other times and kept away for the purpose in a large copy book enclosed in a hermetically sealed tin case. In this way he can often form for himself an idea of the nature or class of colors used for the production of the borders, confirming the observations made by rapid tests and determining whether or not basic, direct, sulphur, ice, mineral or mordant, or aniline black has been employed. Once he has settled this matter he determines how the colors resist the action of boiling carbonate of soda, lime or silicate of soda, in accordance with which of these products is mostly or exclusively employed in the works. This is accomplished by cutting small patterns from the samples received from the bleacher and boiling them one by one for an hour in separate baths of a 1 per cent carbonate-of-soda solution, in the same volume of a 5 per cent fresh-lime bath, or in a

2 per cent solution of silicate of soda, taking out the samples every ten minutes and comparing them with cuttings of the same fabric having a portion of the borders of the original pieces that are kept wet through soaking in hot water and pressing between a pair of clean India-rubber squeezing rollers, and noting if any change in shade has taken place. When the hour has passed the cuttings are dried together with those wetted in the hot water and are compared with the rest of the samples, showing at a glance whether or not the colors used in the pieces to be treated will resist the action of carbonate of soda, lime or silicate of soda, and also if they will resist the action of hot water alone.

THE TESTS FOR RESISTANCE TO HYPOCHLORITES, ACIDS AND SOAPS

While conducting his trials the chemist also determines if the colors of the borders resist the action of soap baths, using for this purpose $\frac{1}{2}$ per cent soap solutions. Should the colors not resist boiling alkalies, a treatment with a soda, lime, silicate-of-soda or soap bath of the same strength, but kept between 50 and 70 deg. Cent., is next used, pressing the cuttings between the clean India-rubber squeezing rollers every ten minutes for three hours and noting the changes in shade and intensity as in the above case. During the investigations the resistance of new cuttings to fresh hypochlorite solutions of 1 to 2 deg. Tw. for one hour is determined. If the colors have not been discharged during the treatment in the alkaline baths, which can be noted after the first thirty minutes of boiling, or after one hour's treatment from 50 to 70 deg. Cent., one-half of each cutting is cut off, and after rinsing it thoroughly in clean running water it is treated in a fresh bath of hypochlorite of soda from 1 to 2 deg. Tw., as indicated above. A portion of the cuttings treated in the hypochlorite baths and new untreated cuttings are then treated in cold acid baths of 1 deg. Tw.

RESISTANCE OF DIFFERENT COLORS TO THE BLEACHING PROCESS

The following coloring matters are not altered when the different scouring and bleaching operations are conducted with the necessary precautions: Alizarine Red, Alizarine Blue, Indigo, Helindone Red, Helindone Scarlet, Helindone Orange, Helindone Brown, Helindone Yellow, Aniline Black, Diphenyl Black, Alizarine Yellow, Alizarine Orange, Primuline treated with an hypochlorite-of-lime bath, etc.

The following colors resist especially well the action of hypochlorite baths: Alizarine Yellow, Alizarine Orange on alumina mordant, Alizarine Blue on chrome mordant, Oxydianil Yellow, Direct Dianil Yellow, Aurophenine, Dianil Scarlet (fast), Metanitriline Orange, Para Red, Azophor Red, Alpha Naphthylamine Bordeaux, Cyanine Thiogene, etc.

The following colors can be dyed so as to be very fast to boiling alkalies: Primuline Yellow, certain brands of

Direct Brown, Sulphur Yellow, Sulphur Orange, Sulphur Brown, certain Sulphur Blues, Helindone Red, Aniline Black, Diphenyl Black, Alizarine Black, Alizarine Red, Alizarine Orange, etc

CONCLUSIONS FROM THE TESTS

Through the above tests the chemist can easily determine the following particulars:

1. That the colors of the borders resist very well the boiling with the carbonate-of-soda, lime or silicate-of-soda bath, and after this the action of the bleaching, souring and soaping operations required for producing a full white.

2. That the colors resist the carbonate-of-soda, hypochlorite and acid baths, but not the final soaping, during which they bleed a bit on the white or are faded, necessitating the elimination of this last treatment and requiring that the bluing be conducted in a weak, cold carbonate-of-soda or ammonium solution.

3. That the colors do not resist the action of the hypochlorite baths, and consequently the souring and soaping that follow, although resisting fairly well the boiling out with carbonate of soda.

4. That the colors do not resist any of the four treatments, being altered in shade or intensity after the boiling with alkali, treatment with sodium hypochlorite, souring or soaping.

5. That the colors resist the treatment with bleaching powder and souring that follows, but neither the boiling with the alkali or the soaping.

6. That although resisting fairly well all boiling out and bleaching, souring and soaping operations, the colors bleed a bit on the whites produced, etc.

PROCESSES RECOMMENDED

From the above results the chemist may have to recommend:

1. The use of the usual bleaching process adopted in the works for the production of the ordinary bleached fabrics having no colored borders.

2. A process where the treatment with the alkali is rendered milder through the employment of weaker alkaline liquors that are kept below the boil throughout the process, entrusting the scouring action mostly to an intensive circulation conducted through the use of a powerful centrifugal pump and lengthening somewhat the period of action.

3. A process where the usual boiling-out process is conducted, or a boiling-out process is conducted below the boil, and where the hypochlorites are either used from $\frac{1}{2}$ to $\frac{1}{4}$ deg. Tw. or are substituted with other bleaching agents, such as peroxide of soda, peroxide of hydrogen, etc.

4. A process where the boiling-out process is conducted as usual, but the bleaching with the hypochlorites is conducted in an alkaline or slightly alkaline medium.

5. A process where the boiling-out process is substituted altogether through a malting process and the goods are treated with the usual hypochlorite and acid baths after this.

6. A process where the scouring operations are conducted with malt baths and the bleaching is conducted with peroxides, etc.

THE WORK OF THE BLEACHER

The work of the bleacher who follows the above recommendations is not very complicated, and he runs no danger whatever of spoiling his goods when the chemist has conducted his investigations properly and with necessary precision. He would, however, have always to follow out very closely the instructions received, leaving the responsibility of the treatment entirely up to the chemist, who should survey and control all boiling-out, bleaching, souring and soaping operations.

THE BLEACHING PROCESS WITH ALKALIES AND HYPOCHLORITES

With the bleaching process based on the use of alkalies and hypochlorites, the boiling-out process plays a very important part, for it liberates from the cotton goods the greater portion of the natural and added impurities covering their surface, penetrating the most intimate cells of which their fibers are constituted and leaving only a small percentage of natural coloring matter, which is later expelled completely during the following bleaching operations.

BADLY BOILED-OUT GOODS

With badly boiled-out cotton cloth it is impossible to produce a perfect white, and if the bleacher employs too strong a hypochlorite for mending matters, besides transforming a portion of the material into oxycellulose and weakening the former considerably, he obtains a white that becomes more and more yellow. For these reasons, if the boiling-out process is not conducted in the most complete manner and with the greatest care there will be great difficulty, or it will even be impossible, to produce a perfect white, besides running the risk of the tendering already referred to. The boiling-out process is usually conducted with lime, carbonate of potash, silicate of soda and carbonate of soda, or other similar detergent substances.

BOILING OUT WITH LIME

Lime appears to have been the first substance employed for the boiling out of cotton warps, and as it is produced from limestone on a very large scale for so many other purposes there is no difficulty in obtaining it everywhere cheaply, and this excludes the necessity of importation. It has, however, a certain number of inconveniences in

the boiling-out process, especially when it is substituted for other alkaline substances

These inconveniences are due to various reasons. In the first place, it is not possible to obtain a product having a uniform strength in calcium oxide, which is the most important portion of a lime for the boiling-out process, and this renders it impossible for the bleacher to count on its efficiency. Secondly, owing to the great quantity of insoluble substances always contained even in the very best products and to the poor solubility of the lime oxide itself it is imperative to utilize only a milk of lime that can be made to circulate uniformly through the whole mass of material and which has present as much oxide of lime as possible. All this increases considerably, of course, the cost of the boiling-out process, and for this reason it is only really to be recommended for those cases where an especially hard finish or grip is desired in the goods in order to make them resemble certain articles of linen.

Moreover, when the cotton-cloth goods are treated with lime they become darker after the boiling-out process than they were in their original gray state, and the further coloring matter taken up and other products formed or deposited in the material have to be eliminated by a sour and a boiling out with carbonate of soda. For this reason the use of lime for the boiling-out process is any-think but cheap, and should only be resorted to when other cheaper methods are not possible for the same class of goods to be produced.

REACTIONS TAKING PLACE

During the boiling out with lime the following reactions take place in the material:

1. If any starch is present it is hydrolyzed and removed.
2. The saponifiable fats, waxes, etc., always present in all qualities of cotton material are changed into calcium salts and remain in the material.
3. A certain percentage of calcium compounds is fixed in the material that is much greater than the equivalent of the fat and wax contained in the yarn.
4. In the souring subsequent to the boiling the calcium compounds are decomposed with precipitation of fatty acids and other substances on the goods.
5. The soda boil which follows eliminates all the fatty acids and other substances which, through its emulsifying action, can be removed. It always leaves, however, a small quantity of a lime compound which, in all probability, owing to its special form and condition, is kept firmly closed up in the most intimate cells of the cotton fibers, imparting to these a certain degree of hardness which is then transmitted to the whole mass of the goods.

CARBONATE OF POTASH

Carbonate of potash was employed before the introduction of carbonate of soda for the boiling-out process, especially in those districts and countries where large

quantities of wood were burnt. In this case the ashes were extracted on the spot with boiling water and the extract was used in a more or less colored and impure form for the treatment of the goods. After the introduction of carbonate of soda this practice has little by little gone out of use, and at present very few cases are to be encountered in which potassium salts are used for the boiling-out process.

SILICATE OF SODA

Silicate of soda was also tried in some works where special finishes were produced through the small traces of the same that remained adhering to the goods after all bleaching and finishing operations. The high price of the product did not, however, permit a very extensive application, and when it was found that the same, or nearly the same, effect could be produced by a treatment of the goods following the bleaching process and carried out during the finishing operations, its employment declined steadily and at present is very limited.

THE CARBONATE-OF-SODA PROCESS

To all the above substances sodium carbonate appears, however, to be preferred by the majority of bleachers for the boiling-out process, as, besides offering advantages for its price and its very high cleansing and emulsifying properties, it is completely free from any insoluble residue and generally contains very few impurities. Besides this, it greatly simplifies matters and is indispensable for those cases where economical and rapid work is necessary. When this product is employed in convenient strength and the bath is made to circulate properly through the material, it is possible to extract the greater portion of the impurities present in the goods without bringing any perceptible weakening to the same or filling or charging them in any way. A similar extraction is greatly quickened through the employment of pressure that compels the alkaline liquid to penetrate into the most intimate cells of the material, thus rendering its chemical and mechanical action more thorough and rapid. In the treatment of cotton cloth with colored borders many prefer, however, to leave out pressure altogether, using low-pressure kiers for the purpose, as brighter effects are obtained in this way.

TREATMENT WITH HYPOCHLORITE OF SODA

The boiled-out fabric is usually rinsed thoroughly, leaving a faint yellow or creamy tint. For eliminating this the pieces are passed through a very dilute solution of hypochlorite of soda and are then allowed, while still moist, to remain in piles and exposed to the air overnight. The bleaching operation takes place largely during this exposure, hypochlorous acid being liberated by the action of the carbonic acid of the air. It is essential that the bleaching powder, or hypochlorite-of-soda solution, should not be too strong, for besides tendering the

material there would be the danger of reducing the intensity of the colors of the borders. The bleaching bath should be maintained as constant in strength as possible by the continuous introduction of a fresh supply of strong hypochlorite in the trough of the machine conducting the treatment.

TREATMENT WITH ACID, SOAP AND BLUING AGENT

After the desired white has been produced in the above manner the goods are given a thorough rinsing, and are then soured in a weak sulphuric-acid or hydrochloric-acid bath, if the colors of the borders can stand it, or the rinsing is conducted more thoroughly and the acids are substituted by a very weak tartaric-acid, acetic-acid or formic-acid bath. The acid bath is followed by a very thorough rinsing, the goods then being soaped in a very weak soap solution containing the bluing agent, and rinsed if necessary. They are then ready for the drying and finishing operations or for dyeing, as the case may be.

MILDER BOILING-OUT PROCESS WITH TREATMENT OF HYPOCHLORITE OF SODA

When it is necessary to render the boiling-out process milder in its action, and it is known that the alkali has no effect on the colors of the borders when the temperature is kept below the boil, the goods are entered in an ordinary kier, where a very thorough circulation is conducted through a powerful centrifugal pump, and are treated here for as long as it is just necessary for eliminating the disintegrating substances and starchy matters in the material. The material is then submitted to the usual rinsing and treatment with hypochlorite of soda, and to the souring and rinsing operations, such as already mentioned above.

The carbonate of soda used in this case must be absolutely free from caustic alkali. This is important, for traces of caustic soda can often be the cause of making the colors in the borders of the pieces being treated bleed or fade.

BOILING OUT WITH SODA AND BLEACHING WITH PEROXIDE

In case the hypochlorite bath would bleach the colors present in the borders, some works treat their cotton pieces as follows: After the usual boiling out with carbonate of soda or a milder treatment with the same alkali in weaker solutions, conducted with reduced pressure and below the boil, and then thoroughly rinsing, they are entered into a bath containing 27 pounds of white concentrated sulphuric acid (66 deg. Be.) in 400 gallons of water and to which has been gradually added 20 pounds of sodium peroxide with constant stirring. The bath is then just made alkaline with silicate of soda (water-glass), and the goods are left in it from ten to twenty-four hours. After the treatment they are rinsed and the operation is repeated if the desired white has not yet been

produced, warming at the end of the operation to 95 deg. Cent.

BLEACHING WITH HYDROGEN PEROXIDE

When hydrogen peroxide is employed, for every 10 kilos of cloth 120 liters of bath are prepared containing 20 to 30 liters of hydrogen peroxide (12 volumes), 1 to 1½ liters of silicate of soda and 1 to 1½ kilos of white olive-oil or cottonseed-oil soap previously dissolved in a portion of the water of the bath of treatment. The goods are then introduced into the cloth bath and the temperature of this is brought slowly to 95 deg. Cent., at which the cloth is agitated from five to ten or more hours, or until the desired white has been produced. After this the goods are rinsed thoroughly with running water and are dried. If the white is insufficient the operation is repeated, reinforcing the old bath, which is maintained slightly alkaline all through.

PROCESS USING MALT

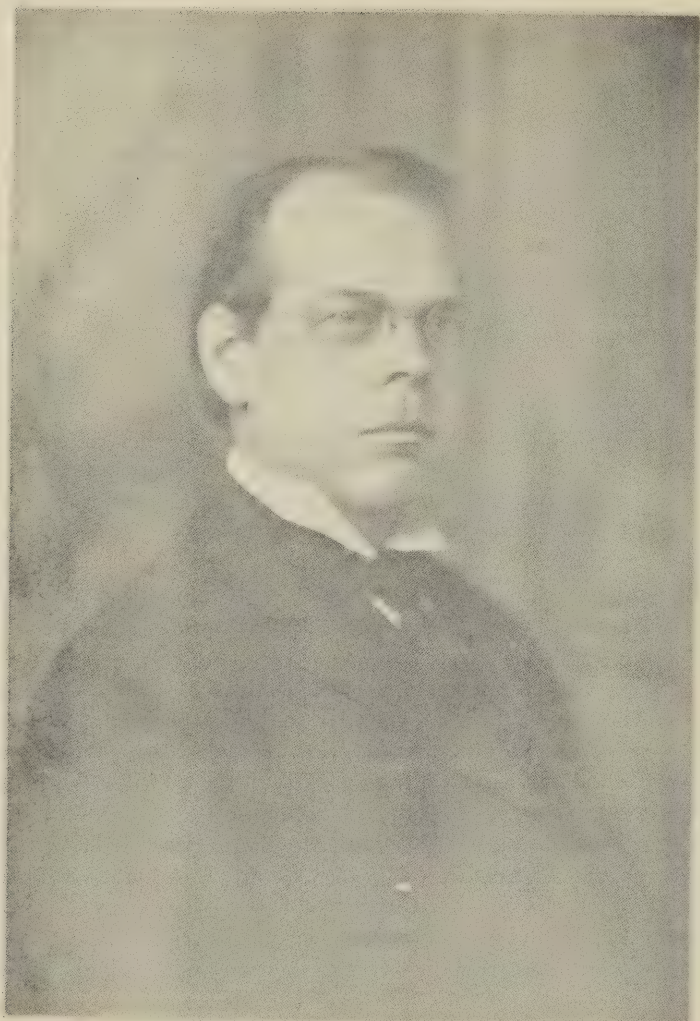
The employment of malt has been introduced in some works, and when properly applied can give very satisfactory results. In this instance the gray cotton-cloth goods are run, during repeated pressing through squeezing rollers, through a bath containing from 3 to 10 pounds of malt extract for every 20 gallons of the bath of water at a temperature of 60 deg. Cent. This bath is followed by a subsequent soaking for twenty-four hours in warm water and by a thorough rinsing. After this the goods are bleached with the hypochlorite bath and are soured as usual.

MALT PRODUCTS ON THE MARKET

Malt extract contains the ferment known as diastase, which has the power of transforming starchy matters into dextrine and glucose. As the diastase loses its action beyond a temperature of 70 deg. Cent., all malt baths have to be employed below this temperature, and preferably toward 50 deg. Cent. There is no doubt that when the malting process is assisted through mechanical means the cleansing operations are much quickened.

CHEMIST'S CONTROL OF BLEACHING OPERATIONS

Tests for controlling how far the colored borders resist during the treatment with the boiling or warm carbonate-of-soda baths, or during the rinsing treatment with hypochlorite, scouring and soaping operations, can also be of great value, sometimes avoiding misfortunes or poor effects. For the purpose the chemist cuts during each operation a bit of the fabric containing the border and, after rinsing it thoroughly and drying, compares it with a similar sample taken from a preceding batch that was treated, dried and kept away out of contact with the light, air and moisture in a hermetically sealed closing tin box and between sheets of paper.



MEN OF MARK in the DYESTUFF FIELD

JAMES L. AMSDEN
Chemist
Rockland Finishing Co., Inc.
Garnerville, N. Y.

JAMES L. AMSDEN was born in Springfield, Mass., in 1878. Soon afterwards his parents removed to Worcester, where he received his preliminary education in the public grammar and high schools. Entering the Worcester Polytechnic Institute in 1896, he took the course in chemistry at that institution and graduated in 1900 with the degree of S.B. He immediately entered the laboratory of the (then) Silver Spring Bleaching & Dyeing Company at Providence, R. I., remaining with that concern and its successors until 1909. Here his activities were varied, for upon the completion of a year in the laboratory he was offered the opportunity to become color-maker and served in that capacity for several years, gradually assuming additional duties until at last he was in complete charge of the coloring of patterns, preparation of print colors, steaming, soaping, and aniline black and ingrain color dyeing.

The succeeding years saw him associated with the S. H. Green & Sons' Corporation's Clyde Print Works at Riverpoint, R. I., in the capacity of colorist, but in 1912 he came to Garnerville as chemist for the Garner Print Works & Bleachery—later the Rockland Finishing Company. Here he soon became closely identified with all manufacturing problems of this concern. He declares that the last seven years have been the most exciting of his professional career, and any textile chemist who has piloted a large plant through this stormy period will be disposed to agree with him, for he has kept close personal watch over all the products used by his firm, from coal and water to soap and dyes, and to keep a big plant of this character supplied with its raw products during the war era, when the market was full of "fly-by-nighters" seeking fortunes by the shortest possible route, was indeed an experience. The tons of tinted salt offered by these gentry, and the weird concoctions which they offered for sale, kept the laboratory running at high pressure. Few of them, however, had the satisfaction of "putting one over" on the Garner Print Works & Bleachery.

Mr. Amsden is a firm friend of the American dye industry, and is warm in his praise of the worthy products of American chemical genius. He believes that a self-contained industry is wanted in this country, not wholly because dye plants can be changed to munition factories on short notice, but because American dyes are as necessary as American-made textiles, and the combination should be and will be the best in the world.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

M. K. Co.—Question: We are forwarding you piece of knit fabric, knit on 18 Ga. Circular Machine, Rib, out of 2/20-14's quality worsted. You will note that this is very streaked, and we shall appreciate it if you will advise us what is the cause of this yarn being streaked. This yarn was all well scoured in one batch and dyed in the Klauder-Weldon Dyeing Machine, and you can notice after it has been wound on the Payne Bobbin that it shows a streak every $\frac{1}{2}$ inch. It would almost convince you that it was different quality, but we can state that this yarn is all made in our own spinning plant and is all one batch.

Answer: It is our belief that your trouble originates in the spinning of the yarn, and that it has nothing whatever to do with the dyeing operation. The probability is that there was too free a use of spinning oil, or that the oil used was of a character which was not readily removed in the scouring operation. Either this is the case or the scouring itself was not properly done.

So many different things might be responsible that it is impossible to diagnose this difficulty at a distance; but it is obvious that the yarn was faulty before it was dyed, or the streak could not have appeared with such regularity. Assuming that the yarn had been impregnated with oil or some other agent at regular intervals before scouring, it would then be a question of the thoroughness with which the scouring operation was carried on or the character of scouring agents which were used.

The temperature of the scouring bath might have had something to do with this condition, as it is well known that at excessively high or too low temperatures portions of the scouring soap become precipitated on the fibers in an insoluble form; if this were the case in the present instance the difficulty would not, of course, show up until after the dyeing operation.

I. V. Co.—Question: We should appreciate your giving us any information you might have regarding dry dyeing as used in connection with textiles.

Answer: We do not know of any literature on this subject. An inquiry among several textile chemists

would seem to indicate that this operation is very little used. Dry dyeing consists in utilizing oil-soluble colors in a gasoline bath. It is not strictly a dyeing operation at all, but is more properly a painting or staining operation.

After a solution of the oil-soluble colors in gasoline is made the fabrics to be dyed or tinted are simply immersed in the solution, and upon evaporation of the gasoline the color adheres to the fabric. As the oil-soluble colors are not affected by water, reasonable permanence is secured.

It is our belief that the process is only suitable for the staining of very light tints and that considerable difficulty might be met in getting level results. Also, we believe that any tint which might be produced in this way could be more satisfactorily accomplished by a regular dyeing operation.

R. P. N.—Question: Is there any special method for dissolving Victoria Blue? I had a man from a dyestuff house dissolve a lot perfectly, but I am unable to get the dye into perfect solution; it seems that the more I boil it the worse it gets.

Answer: Your question states the trouble exactly; the more this dye is boiled the worse it becomes. It is the nature of Victoria Blue to form a condensation product on boiling, hence it should only be dissolved in water at 170 deg. Fahr. It is best stirred up with water and acetic acid in the cold, and hot water added, but not boiled afterward, or a bronzy scum will separate and neither a further addition of acid nor more heat will remedy matters.

A. P. P.—Question: I have been recommended to use the American equivalent of Diamine Fast Red F as a chrome color on wool. Do you consider it a suitable dye for such a purpose?

Answer: Diamine Fast Red F is a remarkable dye in that it dyes all fibers and works by all the chrome processes. When dyed on wool by after-chrome, chrome mordant or chromate process, it has a fastness nearly equal to alizarines and very much brighter. It may be used for shading fancy combinations and will be found to be very economical.

L. P. J.—Question: Is there any way that hydrosulphites can be used for cleaning the hands when stained by dyes?

Answer: As all the hydrosulphites are only effective at temperatures near boiling, it has so far not been possible to utilize them for such a purpose. Chloride of lime and soda remain the best things we know of.

Review of Recent Literature

Scouring and Milling. J. Schofield, B.Sc. Huddersfield, England: Netherwood, Dalton & Co.

This book on the science and practice of cloth scouring and milling in the woolen and worsted industries is a valuable addition to textile literature. It deals with a subject which is admittedly difficult to reduce to terms of an exact science, but the author has certainly provided the means whereby scientists and practical millers and scourers can greatly increase their knowledge of the art. As far as present knowledge goes, the author has endeavored to present a clear and well-defined theory of the fundamental principles of milling; and although he quotes freely the conclusions of other research workers, he writes from a close study of the subject. The remarks on the theories of the felting properties of wools are particularly useful, and should materially assist to a fuller knowledge of this important subject. All through the book there is evidence of the author's close study of and practical acquaintance with the factors that make for the successful scouring and milling of wool piece-goods. He deals in succession with the properties and uses of water and steam in the scouring shed; the effects of acids, alkalies and salts on wool; the chemistry of oils and fats, and their legitimate uses as lubricants in spinning; the properties of soaps and other detergents; the theoretical principles of washing, cleansing or detergent action; practical scouring; the chemistry of the wool fiber; milling; and the waterproofing of fabrics. The book is freely illustrated, is well written, and should be in the hands of everyone engaged in the scouring and milling of wool fabrics, as well as those engaged in the teaching and study of the subject.

Eminent Chemists of Our Time. Benjamin Harrow, Ph.D., Associate in Physiological Chemistry at Columbia University; author of "From Newton to Einstein." 250 pages, 5x7½; illustrated; \$2.50. New York: D. Van Nostrand Company.

This volume has a distinct appeal to the general reader as well as to the technologist or student desiring inspirational and picturesque matter relative to the lives and achievements of the more modern chemists. Though non-technical, it is not without a certain value as a work of reference when it is desired to refresh the memory as to the outstanding works of our latter-day leaders in chemical thought and action. There is hardly a chemist of note whose work is not mentioned in connection with one or another of the eleven following: Perkin and Coal-Tar Dyes; Mendeleef and the Periodic Law; Richards and Atomic Weights; Ramsay and the Gases of the Atmosphere; van't Hoff and Physical Chemistry; Arrhenius and the Theory of Electrolytic Dissociation; Mois-

san and the Electric Furnace; Curie and Radium; Victor Meyer and the Rise of Organic Chemistry in America, and Fischer and the Chemistry of Foods.

Among the many reasons for its appeal to both lay and technical readers, excellence of literary style is not the least. Into his account of the epoch-making accomplishments for which his subjects are remembered the author has brought just the right proportion of imagination, coupled with a nice sense of what may justly be termed the dramatic values, and *The Reporter* is confident that the mature chemist can regain from a perusal of its pages something of his undergraduate realization of the glamour which—though temporarily lost sight of, perhaps—will continue to surround the Great Adventure of Chemistry as long as men shall be willing to embark upon it.

Textile Design and Color. W. Watson. Second edition, illustrated; 21s. London: Longmans, Green & Co.

Enlarged and revised, and possessing many additions to cover developments since the appearance of the first edition nine years ago, this useful work is quite up to date in every respect and should be of unquestioned value to those engaged in the designing or coloring of textile materials. A new feature which deserves mention is the section dealing with standard yarns, weaves and fabrics. This occupies about 125 pages and takes the form of an appendix, being arranged in three divisions treating respectively of Standard Yarns, Standard Weaves, and Standard Fabrics. The names are given in alphabetical order, and the description of each is concise and at the same time comprehensive, after the manner of a good dictionary. The work is well printed on good paper, so that neither the text nor the upwards of 2,000 illustrations suffer. There is likewise a very full index—a very necessary adjunct, it need hardly be added, to a book covering such a wide field.

The Cotton Textile Worker's Handbook. Compiled by C. J. Brickett. Scranton, Pa.: The International Textbook Company.

This is a useful reference book, of convenient pocket size, containing a collection of rules, tables and data concerning the spinning of cotton yarns, the weaving of cotton fabrics, and the yarn and cloth calculations incidental thereto. The publishers have attempted to select only that information which is most likely to be of use in connection with daily work, and have succeeded in producing a valuable handbook. The first part deals with yarn calculations, including yarn numbering, roving numbering and twist tables; breaking weights of cotton yarns, ply yarns, etc. Cloth calculations are concisely treated and drafting calculations carefully explained. Notes are given on cotton yarn preparation, including brief resumes of the functions and actions of the various machines. A section is devoted to a description of methods of preparing warps, and a further section to notes on weaving and the care and management of looms.

Recent Patents

Apparatus for Coloring or Printing Thread

(1,384,940; July 19, 1921)

HOWARD P. DENISON

In an apparatus for coloring yarn, thread or the like, means for moving the yarn longitudinally, a rotary absorbent member adjacent the yarn, means for applying dye to said rotary member, and means for intermittently causing the yarn to wipe across the periphery of said rotary member, without interrupting the longitudinal movement of the yarn.

Apparatus for Comparing, Matching and Measuring Shades and Colors

(1,384,513; July 12, 1921)

HIBBARD S. BUSBY (assignor to Cheny Brothers, South Manchester, Conn.)

In an apparatus of the class described, the combination of primary, secondary and tertiary sectors fixed against axial movement relatively to one another, means for rotating these sectors simultaneously about a common axis, and means for angularly adjusting at least two of the sectors relatively to each other and to the third sector while they are being rotated, said means for adjusting each adjustable sector being independent of the means for adjusting any other sector.

Support for Hanks of Silk, Yarn and the Like in Treating-Machines

(1,384,052; July 12, 1921)

JOSEPH A. DISCHINGER

This is a machine for treating hanks of silk and the like having an arm for supporting the hanks which comprises an arbor, a plurality of disks mounted in spaced relation on the arbor, and each having a plurality of notches arranged in an annular row in the periphery of the disk, and a plurality of longitudinal rods arranged in an annular row around the arbor and each secured with its inner side in corresponding notches in the disks in such position that the outer side of the same is arranged radially outward beyond the periphery of the several disks.

Dyeing and Bleaching Apparatus

(1,388,081; August 16, 1921)

ALOYSE WOLAND

This is an apparatus for dyeing and bleaching vegetable and animal fibers on bobbins or beam rollers, comprising: a reservoir for the dyeing or bleaching bath,—two vats arranged above the reservoir,—perforated tubes mounted in the vats and receiving the materials to be dyed or bleached,—a system of piping connecting the vats together and with the reservoir,—a rotary pump with

a reversing gear interposed in the system of piping, between the two vats containing the products and permitting the operator to obtain the circulation of the dyeing or bleaching bath from the reservoir and to direct it into either of the vats, or from one vat to the other; means for washing the textile materials, means for oxidation of the fixed colors and means for drawing off the baths.

Colorimeter and the Like

(1,389,836; September 6, 1921)

MELVIN MOONEY

A device for testing a material to ascertain its color by a method which consists in combining the color of the material with its complementary color, and also combining the same complementary color with a standard of comparison such as to produce gray light, to thereby produce gray light in both instances, and which consists in simultaneously observing both of the gray lights produced for purposes of comparison, whereby the standard of comparison becomes a measure of the color of the material under test.

Textile Fabric Treating Machine

(1,389,627; September 6, 1921)

LOUIS CLARENBACH

The machine described consists of a vat, for treating textile fabrics in open width with liquid, consisting of a compartment, a frame structure arranged in this compartment with fabric-carrying rollers, means for operating the frame to cause the fabric to engage the liquid flatwise while in the substantially vertical position, and means for feeding the fabric through the compartment.

Apparatus for Finishing Velvet and Other Nap Fabrics

(1,390,093; September 6, 1921)

JOSEPH CUCUMEL

The apparatus consists of a frame, a table, a reservoir containing a liquid for the humidification of the fabric, rollers in the reservoir, a card comprising two cylinders provided with steel teeth, means for regulating the pressure of these cylinders, heating means for the nap-rising mechanism, a calender arranged after the heating means and also heated thereby, means for regulating the height of this calender, a second card in the rear of the calender and rotating in the opposite direction to the first card, a stretching frame above the table, means for regulating the inclination of the stretching frame and means for guiding the fabric to the table where it is piled up.

Speck Dye Composition

(1,377,790; August 2, 1921)

OSCAR L. PETERSON

Consists of a dyeing composition comprising 4.6 per cent sodium chloride, 3 per cent copper sulphate, 1 per cent tartar emetic, 9.2 per cent alkali, 27.7 per cent water, and 55.4 per cent hematine paste.

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IN 2 SECTIONS
SECTION 2

IN THIS SECTION

In an article entitled "Heat Balance in the Kier Boil," Paul A. Merriam, Chemical Engineer of the United States Finishing Company, discusses the consumption of steam in both direct and indirect heated kiers.

The sixth paper of Prof. Louis A. Olney's series on "Operations Preliminary to Dyeing Wool Fiber" deals with the extraction process of degreasing wool and points out the many advantages of this little-used method.

Walter F. Haskell, dyer for the Dana Warp Company, Westbrook, Me., describes a new tubular warp-dyeing machine of which he is the inventor.

In the third paper of his series on "The Control of Bleach-House Processes," H. W. Eastman discusses liquid chlorine as a bleaching agent.

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Section 2

Heat Balance in the Kier Boil

An Analysis of the Steam Consumption in Both Direct and Indirect Heated Kiers

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STEAM is used in connection with the kier boil to supply heat to bring the contents of the kier up to a certain desired temperature, to maintain that temperature during the time required to accomplish a satisfactory boil, and to keep the liquor moving or circulating through the cloth during this time. This heat is applied either by admitting the steam directly into the kier liquor (see Fig. 1) or by circulating this liquor through a closed heater, in which case the steam is said to be applied *indirectly* (see Fig. 2). In either event the function of the steam is the same. In the one case, however, the steam mixes directly with the kier liquor, heating it and circulating it at the same time, while in the other case the heat only of the steam reaches the liquor, and the circulation is produced not by this same steam but by other steam which may be driving the prime mover from which comes the energy which drives the circulating pump.

There are, of course, many types of kiers in use which employ various combinations and variations of the above, but for simplicity we have confined ourselves in this discussion to the two fundamental types as given above.

It is the purpose of this article to show a balance between the total steam supplied to the kier and the total steam required to accomplish the desired results in the kier. In other words, it is proposed to account for the steam used during the kier boil.

Let us first analyze the various things done by the heat that is supplied. These are the following:

1. Temperature of cloth is increased.
2. Temperature of liquor is increased.
3. Temperature of kier itself is increased.

4. Temperature of whole mass is maintained against radiation.

5. A circulation of the liquor is produced.

6. (In indirect heated kier only.) Heat is rejected by pump in form of exhaust steam.

7. (In indirect heated kier only.) Heat is rejected by heater in form of hot condensed steam.

8. Some heat may be lost through relief valves and vents.

9. Unaccounted-for losses and leakage.

There follows a discussion of these nine items in turn, after which there will be shown heat balances based on data derived from actual tests.

1. *Heating the Cloth.*—The amount of heat required to heat the wet cloth in the kier is found by multiplying the weight of the wet cloth in pounds by the number of degrees Fahrenheit that it has been heated, and multiplying this product by the specific heat of wet cloth. The result will be in British thermal units.

In order to ascertain the specific heat of wet cloth we have started on the basis that the specific heat of dry cellulose is 0.37. This figure will be found in various chemical handbooks. The specific heat of dry cloth is assumed to be practically the same, and, of course, the specific heat of the moisture contained in the wet cloth is unity. Thus the specific heat of the wet cloth will be the weighted mean between the cloth itself and the moisture that it carries. It generally happens in practice that the wet cloth that enters the kier contains its own weight of moisture, so that in this case the specific heat of the wet cloth will be $0.37 + 1 \div 2$, or 0.69.

2. *Heating the Liquor.*—Since the liquor in the kier is chiefly water with a specific heat of one, the heat consumed in raising the temperature of this liquor is simply the product of its weight in pounds by the number of degrees Fahrenheit that its temperature is raised.

In the case of the direct-heated kier, the weight of liquor that requires heat is actually the sum of the liquor in the kier at the start of the boil and the condensed steam added to it during the boil, less the amount of liquor that is vented. With the indirect-heated kier, however, as a result of the heater, the condensed steam is kept separate from the liquor and is drained off for use elsewhere. Thus in this kier the liquor that is charged with heat is simply the original charge less the small amount that may be vented.

3. *Heating the Kier.*—To find out how many heat units have been expended in heating the kier itself, we take the product of the weight of the kier and accompanying pipes in pounds by the number of degrees Fahrenheit that this amount of material has been heated. This product is then multiplied by the specific heat of the combined materials involved. The material is chiefly steel with a specific heat of 0.117.

4. *Radiation.*—The heat requirements so far call for heat only during the early part of the boil, as will be pointed out later, for when the various materials are once brought to the working temperature no more heat is needed for temperature-raising purposes. However, there will be heat called for to maintain the working temperature against radiation. This requirement commences just as soon as the temperature of the kier surface rises above the room temperature. It increases as the temperature increases, and continues just as long as the kier surface is hotter than the room.

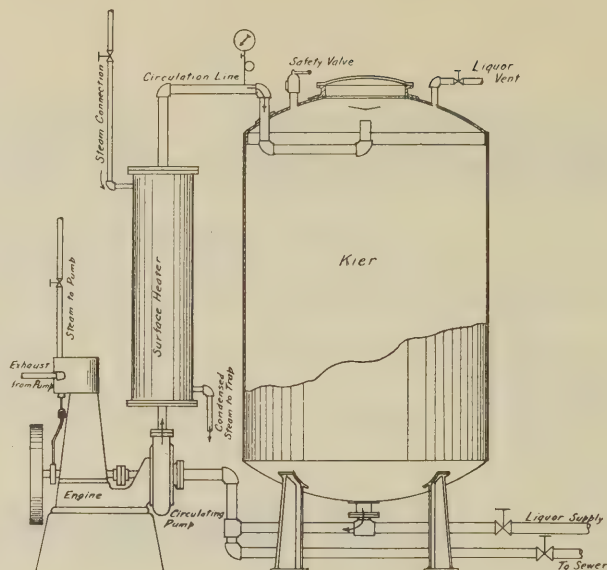


FIG. 2.—Diagrammatic Sketch Showing Indirect Application of Steam to Kier and Pump Circulation

Experiments have indicated that each square foot of total kier and piping surface will radiate per hour 2.4 B.t.u. per degree Fahrenheit difference in temperature between the surface and the room. Thus we can ascertain the radiation loss during the kier boil by multiplying together 2.4 times the number of square feet of kier and piping surface, times the length of boil in hours, times the average temperature difference between room and kier surface. The resulting product will be in British thermal units.

The constant 2.4 used above applied particularly to unjacketed kiers. If the kier can be covered with some insulating covering this figure can easily be reduced to less than 0.6. A discussion of this point will appear later in comparing the circulation in "direct" and "indirect" heated kiers.

5. *Circulation.*—In the case of circulation we have a fundamental difference between the direct and indirect heated kiers. It will be necessary to take up each case separately.

In the direct steam kier the circulation is produced by introducing the steam into the circulation line through an injector (see Fig. 1). The injector is similar to the device by the same name that is used for forcing feed water into boilers against the boiler pressure. Circulation comes as the result of the kinetic energy in a jet of steam aided by the suction effect caused by a condensation of this steam. This method of circulation works satisfactorily as long as the liquor in the lower part of the kier is at a materially lower temperature than the steam. For this reason it is impracticable to jacket kiers of this type, since if this were done there would not be sufficient loss of heat by radiation to keep the liquor in the bottom of the kier cooler than the steam. The result

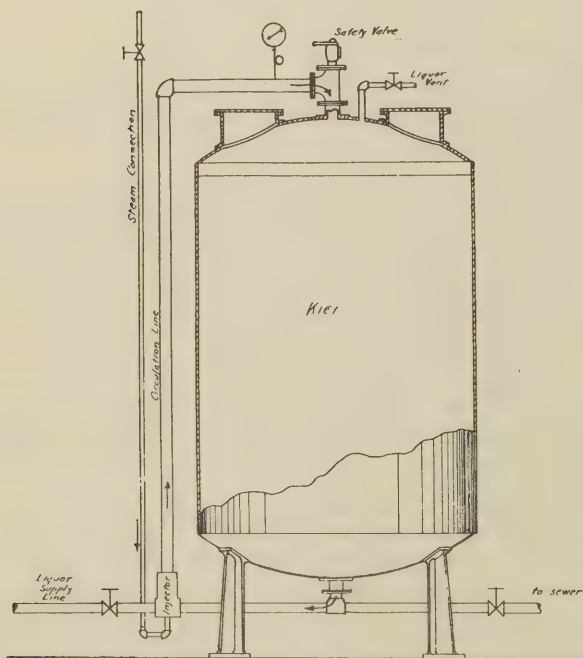


FIG. 2.—Diagrammatic Sketch Showing Steam Applied to Kier Directly with Injector Circulation

would be that the entire contents of the kier would reach a uniform temperature equal to the steam temperature and there would be no condensation taking place to draw liquor into the injector. Thus, instead of throwing a column of liquor up the pipe the steam alone would blow up through and no circulation would result.

Theoretically there is no expenditure of heat in producing the circulation in an injector kier, since the heat of the steam is used up in raising temperatures, in radiation and in other losses. Whatever heat may be converted into work in setting the liquor into motion is returned to the liquor in the form of heat resulting from friction of the liquor in the pipes and through the cloth.

In the case of the indirect-heated kier (see Fig. 2) the steam supply is kept apart from the liquor and has nothing to do with causing it to circulate. Additional energy has to be expended, however, in order to drive the liquor pump.

This energy may come from any available source. It may come to the pump through line shafting and belts, or the pump may be motor-driven, or, most simple of all, the pump may be direct-connected to a small steam engine. In any case energy has been expended somewhere and this energy represents a certain number of British thermal units. We have taken as the simplest case a pump direct-connected to a small engine so that the British thermal units expended in driving the pump are actually spent at the kier.

Thus the heat that has to be used in bringing about a circulation of the liquor is the weight of steam consumption of this small engine times the difference in heat content of 1 pound of live steam supplied and 1 pound of the engine exhaust. However, "circulation" can be credited with a part of this heat, since the work done by the pump actually generates heat in the system as the result of friction. The heat equivalent of 1 h.p. is 2,547 B.t.u. per hour. Therefore, the amount of this credit is 2,547 times the length of boil in hours, times the power consumption of the pump.

An important difference between the two methods of circulation is that in the case of direct steam it is not possible to do away with radiation loss by jacketing, whereas with indirect steam it is possible and desirable to jacket the kier so as to reduce this loss. As will be shown later, it is possible to reduce the radiation loss with pump circulation enough to more than compensate for the additional steam required to drive the pump.

6. Heat Rejected in Exhaust Steam from Pump Engine.—The steam exhausted from the prime mover that made power for the pump contains a definite amount of heat which should not be charged to circulation, since it can be made available for use elsewhere. The amount of this heat is the weight of exhaust steam times the number of heat units per pound contained in the exhaust over and above prevailing temperature.

This item, of course, applies only to kiers with mechanical circulation.

7. Heat Rejected by Heater in Form of Condensed Steam.—In indirect-heated kiers the steam supply does not mix with the liquor, so that the steam which enters the heater, after it has given up its heat by condensing, is trapped out in the form of hot condensate. This item will contain the number of heat units obtained by multiplying the weight of this condensate by the difference between its temperature and the prevailing temperature. A large part of the heat in this item is available for use elsewhere in the plant wherever hot distilled water may be needed. The logical disposition is to return it to the boilers as hot feed water.

8. Venting.—In the case of venting the heat requirements of the two types of kiers call for separate treatment, though the amount of heat lost in this way can be figured in a similar manner for each case.

Venting is necessary for two reasons. In the first place, it is essential during the early part of the boil to have an opening at the top of the kier through which any air that may be inside can be forced out. The presence of air in a kier during the boil results in tender cloth, and it is very important that all such air be forced out. This applies both to direct and indirect steam kiers. The other reason for venting applies only to direct steam kiers. For with direct steam kiers the volume of kier liquor is increasing during the boil as the result of the addition of condensed steam. After a while the kier becomes entirely filled with liquor, and were some of this liquor not allowed to escape through the vent no more steam could enter the injector.

Thus, with kiers using direct steam, venting must go on during the entire boil, whereas with indirect steam kiers the vent can be closed tight just as soon as all the air has been driven out.

The amount of heat spent in this way can be determined by arranging the vent of the kier to discharge in a vessel filled with cold water and noting the increase in weight and in temperature of this water during the discharge. By allowing the vent to discharge in this way for a few minutes each hour, the total heat lost by venting during the entire boil can be calculated. The weight of vented liquor is to be subtracted from the total liquor to give the amount of liquor actually to be charged with heat. (See paragraph on "Heating the Liquor.")

9. Leakage and Unaccounted-For Losses.—It will be found that the sum of the preceding eight items will not quite equal the total heat supplied to the kier. Therefore it is necessary to write this difference down as leakage and unaccounted-for losses. This figure will vary, depending upon the accuracy with which the preceding items are determined and the extent of leaks in the kier, valves and piping.

TOTAL HEAT SUPPLY

Let us now consider how the total heat supply is arrived at. In the case of the kier where the steam is supplied directly, the total heat supply is the number of heat units, over and above the prevailing temperature, contained in each pound of steam, multiplied by the number of pounds of steam supplied during the boil.

In the indirect-heated kier the total heat supply is the sum of the heat contained in the steam that enters the heater plus the heat contained in the steam which runs the engine and pump. It should be borne in mind, however, that the net amount of heat chargeable to a kier of this kind can be reduced, depending upon to what extent the rejected hot condensate and the engine exhaust are taken advantage of.

Table I shows test data for two kier boils reduced to a common basis, and to simplify calculations, with allowances made to reduce starting temperatures to a common datum of 68 deg. Fahr. In the first column are results for a kier with direct steam and with injector circulation. In the second column are corresponding results for a kier of similar size but with pump and heater circulation.

TABLE I

	Direct Steam	Indirect Steam
Length of boil, hrs.....	12	12
Radiating surface of kier and auxiliaries, sq. ft.	375	395
Weight of kier and auxiliaries, lbs.....	7,820	8,510
Weight of dry cloth, lbs.....	8,400	8,400
Weight of moisture in cloth, lbs. (assumed) ..	8,400	8,400
Weight of liquor in kier, lbs.....	16,300	21,400
Weight of liquor vented, lbs.....	3,700	450
Heat loss by venting, B.t.u. (see paragraph 8)	1,560,000	160,000
Weight of steam to kier, lbs.....	8,610	7,550
Weight of steam to pump engine, lbs.....	....	720
B.t.u. per lb. above 68° F. of steam in line....	1,145	1,145
B.t.u. per lb. above 68° F. of engine exhaust..	....	970
Temperature of kier and contents before boil, °F.	68	68
High temperature of kier and contents during boil, °F.	245	245
Average temperature during boil, °F.....	225	216
Average temperature of heater condensate, °F .....	....	252
Temperature of kier room, °F.....	68	68
Horse-power of pump.....	....	1.3

Table II shows comparative heat balances for these two kiers based on the data contained in the preceding table. The results are in British thermal units as well as in percentages of the total.

TABLE II

Heat Supply:	Method of Arriving at Result		B.t.u.		% of Total	
	Direct Steam	Indirect Steam	Direct	Indirect	Direct	Indirect
Heat supplied to kier.....	8,610 lbs. × 1,145 B.t.u.....	7,550 lbs. × 1,145 B.t.u.....	9,858,450	8,644,750	100.0	91.3
Heat supplied to pump.....		720 lbs. × 1,145 B.t.u.....		824,000	...	8.7
Total heat supply.....	8,610 lbs. of steam.....	8,270 lbs. of steam.....	9,858,450	9,469,150	100.0	100.0
Heat Consumption:						
1. Heating the wet cloth....	(8,400 + 8,400) lbs. × (245 — 68) °F. × 0.69.....	(8,400 + 8,400) lbs. × (245 — 68) °F. × 0.69.....	2,051,784	2,051,784	20.8	21.6
2. Heating the liquor.....	(16,300 + 8,610 — 3,700) lbs. × (245 — 68) °F.	(21,400 — 450) lbs. × (245 — 68) °F.	3,754,170	3,708,150	38.1	39.2
3. Heating the kier.....	7,820 lbs. × (245 — 68) °F. × 0.117	8,510 lbs. × (245 — 68) °F. × 0.117.....	161,874	176,157	1.6	1.9
4. Radiation	2.4 × 375 sq. ft. × 12 hrs. × (225 — 68) °F.....	0.6 × 395 sq. ft. × 12 hrs. × (216 — 68) °F.....	1,695,750	420,912	17.2	4.4
5. Producing circulation.....		720 lbs. × (1,145 — 970) B.t.u. — 1.3 h.p. × 12 hrs. × 2,547 B.t.u.....		86,267	...	0.9
6. Exhaust from pump.....		720 lbs. × 970 B.t.u.....		693,400	...	7.4
7. Hot condensate from heater		7,550 lbs. × (252 — 68) °F....		1,389,200	...	14.7
8. Venting	By 5-min. tests made hourly..	By 5-min. tests made hourly..	1,560,000	160,000	15.8	1.7
9. Unaccounted for	By balance	By balance	634,872	778,280	6.5	8.2
Totals			9,858,450	9,469,150	100.0	100.0

Fig. 3 shows graphically the data that is tabulated in Table II. On one side is the heat balance for the direct heated kier, while directly opposite is the balance for the indirect-heated kier. The various items are shown opposite each other so that the heat disposition of the two kiers can be more readily compared.

Before drawing conclusions regarding this comparison it will be well to take into consideration the graph-

ical log shown in Fig. 4. This log shows comparatively the variations in hourly heat consumption and kier temperature during the progress of the boil. The full lines refer to direct-heated kiers and the dotted lines to indirect-heated kiers.

Fig. 4 shows that the boil is naturally divided into two periods, the temperature-raising period and the boiling period. The first period requires by far the

greater amount of heat, for when the temperature is once raised the only further requirement for heat is the production of circulation. The length of time required to raise the temperature depends upon how fast heat can be applied. With plenty of steam and liberal pipe sizes and heater, this period can be made considerably less than shown in Fig. 4. Moreover, if the kier charge could be independently heated a considerable saving in time could be effected. In the comparison actually shown in Fig. 4 the indirect-heated kier is taking heat somewhat faster than is the direct-heated kier during the first part of the boil, and hence the desired temperature is reached about two hours earlier. In each case, it will be noted, the heat consumption drops rapidly just as soon as the final temperature is reached. This means ordinarily that an automatic pressure-reducing valve controlled by kier pressure shuts off the excess steam and allows just enough to pass to maintain this pressure and circulation. In the indirect-heated kier with pump circulation the heater steam can actually be shut off entirely just as soon as the final temperature is reached. Steam is, of course, still driving the pump, and the hot liquor is thus kept in circulation. With a suitable jacket on the kier the temperature drop will be less than 4 degrees per hour, so that the boil can continue for six or eight hours

without the addition of new heat and still leave a temperature corresponding to several pounds' pressure at the end of the boil. The direct-heated kier is not able to take advantage of this stored-up heat, because the heating and circulation steam are not separate.

It should be noted also that in the case of the indirect-heated kier the vent can be closed shortly after the kier temperature passes 212 deg. Fahr. and the pressure in the kier rises in consequence, whereas in the direct-heated kier it is customary, if not actually necessary, to leave the vent open during the entire boil.

Having now analyzed what becomes of the heat that is used in the kier boil, it is in order to see what can be done to make the kier more economical. In the first place, it appears that the indirect-heated kier will save some heat over the direct-heated kier, chiefly because the indirect-heated kier can employ insulation and thus reduce its radiation to about one-quarter that of the direct-heated kier and because it can eliminate so much of the venting loss. Moreover, the indirect kier can be credited with the heat contained in the hot drip from the heater and in the exhaust from the pump, provided means are afforded elsewhere for utilizing this valuable heat. The drip can be returned under pressure to the boilers as hot feed, and the ex-

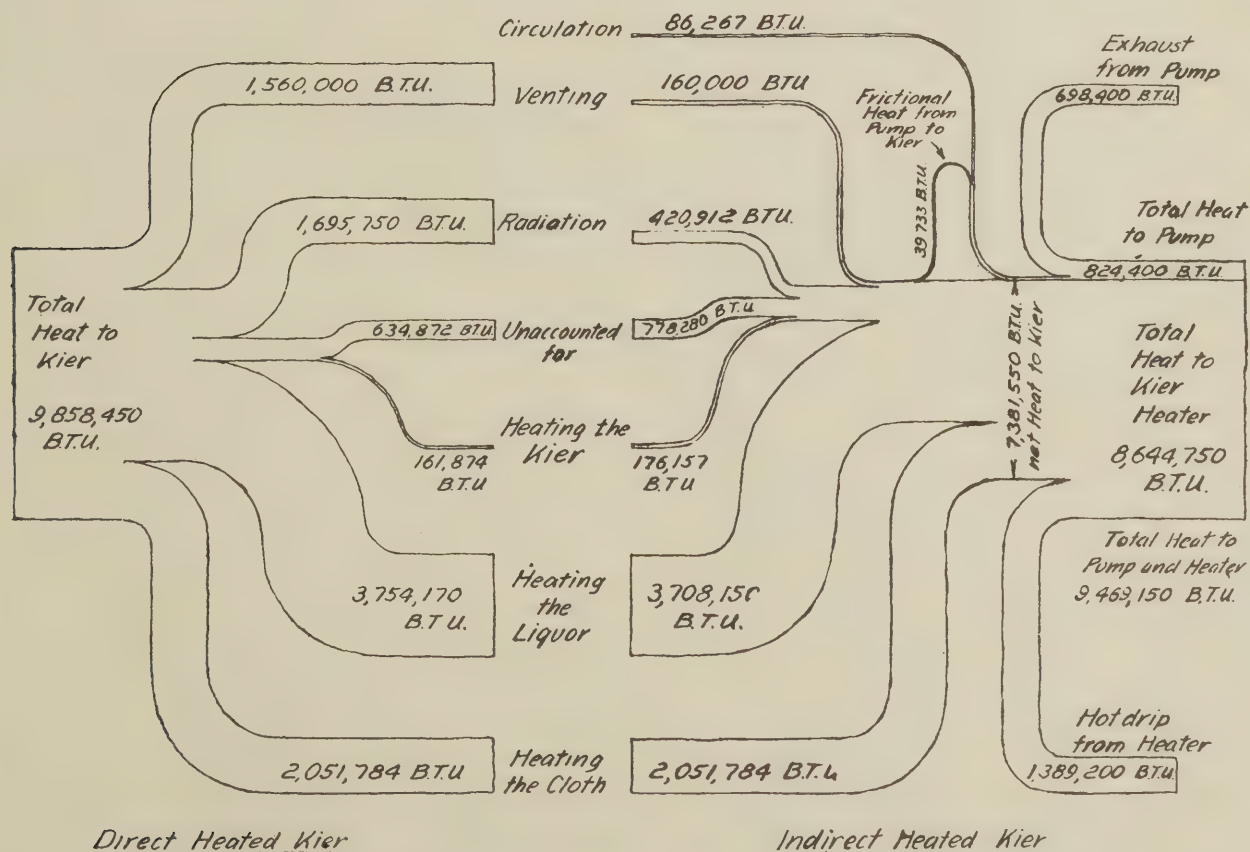


FIG. 3—Comparative Heat Balances for Direct and Indirect Heated Kiers

haust can be piped to the feed-water heater or for heating the charges of succeeding boils. Thus, whereas the direct-heated kier might use 9,858,450 B.t.u., the indirect-heated kier will do the same work for 7,381,550 B.t.u.

Heating the liquor is the largest item for both types of kiers. Every effort should be made to preheat this liquor with exhaust steam from other parts of the plant. In many plants there are times during the day when some exhaust steam gets away. If this could be piped so that it would give up its heat to kier liquor stored in large tanks it would result in a clear gain to the plant. The same is true of the heat required to heat the cloth. If the liquor used in the prepare machines could be preheated with waste exhaust there would result another gain to the plant. Roughly speaking, a saving of 1 per cent will result from every 5 degrees that the kier liquor and cloth are preheated.

A common waste in kier operation comes from ex-

cessive venting. This should be watched carefully, as should all leakages in the system. There is no need to have safety valves blowing away heat. An automatic reducing valve to control the flow of steam to the kier is a very desirable thing to have, in that it prevents the loss of heat through the safety valve.

In the case of the indirect kier it should be borne in mind that jacketing will save about 12 per cent of the total heat consumption and that considerable heat can be saved by shutting off the steam when the high temperature is reached, thus using up some of the heat stored in the system.

Although the average 5-ton kier is using considerably more than 10,000 pounds of live steam per twelve-hour boil, it is apparent from a study of the preceding discussion that this steam consumption need not be more than 6,000 pounds, provided proper care and provision are made to conserve the heat supply.

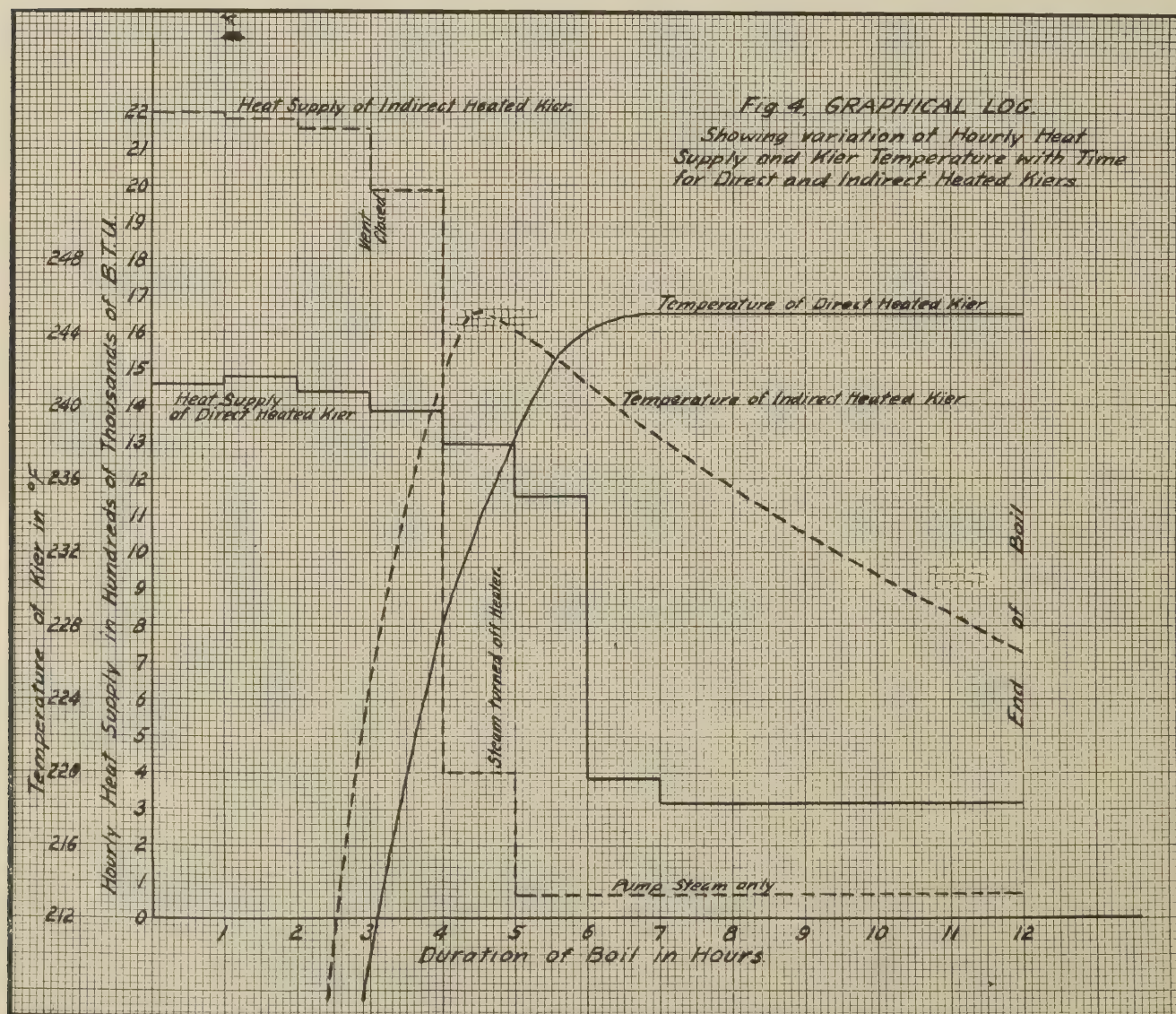


FIG. 4—Full Lines Refer to Direct-Heated Kiers and Broken Lines to Indirect-Heated Kiers

Operations Preliminary to Dyeing Wool Fiber— Part VI—Extraction Process of Wool Degreasing*

An Outline of the History and General Principles Involved, and a Description of the Process

By LOUIS A. OLNEY

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A THOROUGH study of the subject of wool cleansing is quite sure to lead to the conclusion that the extraction method; i. e., the treatment of the raw wool under proper conditions with certain organic solvents, is far more scientific in principle than the ordinary emulsive process which has been described with some detail in previous articles.

The extraction process not only insures a positive removal¹² of the wool fat, but also leaves the wool in better condition than the emulsive process, and if carried out in the proper apparatus it is possible to recover not only the valuable extracted wool grease, but also the extracting medium with an almost inappreciable loss.

With efficient apparatus and good management, the expense of cleansing wool is reduced to a minimum by this process, and the results obtained approach the maximum established through theoretical and economical considerations.

These being facts, the question is naturally asked, Why is the emulsive process used at all? also, Why is it that not more than two plants are successfully using the solvent process in this country? There are several answers, among the most important of which are, first, the enormous initial outlay for the construction of a plant; second, the fact that until recently, at least, many of the devices and working principles necessary for its successful accomplishment have been controlled by patents, and third, the inherent dread of the fire and accident risks which, during the early attempts to develop this process, were numerous and fatal.¹³

¹² It has sometimes been said that this process was too effective in this respect, not only removing the superficially deposited wool grease, but in addition some of the normal 1 per cent of internally located natural grease which seems so essential for the maintenance of the natural softness and pliability of the wool fiber. If the extraction process and subsequent treatments of the wool are properly carried out this need be no objection whatever. This statement is substantiated by the fact that the Arlington Mills has, during the past few years, degreased, carded and spun several hundred million pounds of wool by this process.

¹³ A plant of sufficient size to be practical and operate economically would cost several hundred thousand dol-

*Read in part before the Dye Division of the American Chemical Society and published by their courtesy

HISTORICAL CONSIDERATION

Although for many years the value of such reagents as carbon bisulfide, benzene and petroleum naphtha was recognized as solvents for wool grease, it was not until the latter part of the nineteenth century that any successful practical application was made of them for commercial wool cleansing. Several instances are recorded where processes were devised for using carbon bisulfide for this purpose, one notable instance being at the works of Sir Isaac Holden in Bradford, England. Other solvents were tried both in America and abroad and, while they were in some instances successful as far as removing the grease was concerned, practically they were failures, chiefly on account of the inflammable nature of the solvents and lack of proper appliances for controlling their use and preventing dangerous fires and explosions. Disastrous fires and explosions were frequent during their operation and several instances of loss of life are recorded. Most of them were discontinued on account of their hazardous character and those remaining were finally ended through complete destruction of the plant.¹⁴

The cost of carrying out these early processes was also excessive, as the apparatus was not at all efficient in the recovery of the expensive solvents.

As early as 1879 experiments are recorded in the Bulletin of the National Association of Wool Manufacturers in regard to the use of petroleum naphtha as a wool degreasing agent. It was found to be cheaper than carbon bisulfide and its final success was predicted.¹⁵

lars and several times as much as an emulsive plant of the same capacity. It has therefore been dismissed even as a possibility for any but the largest mills. The essential parts of the apparatus and process have also been so carefully guarded by patents that those attempting to carry out the process have become so involved in litigation that others have been discouraged in making similar attempts.

¹⁴ The city of Bradford, England, finally prohibited the use of the solvent process of degreasing wool, as being a public menace.

¹⁵ Mrs. Ellen H. Richards, for many years an instructor at the Massachusetts Institute of Technology, was one of the earliest experimenters along this line, and the results of some of her work are recorded in the Bulletin of the National Association of Wool Manufacturers.

VALUABLE FEATURES OF PROCESS

Many practical incentives sufficed to keep interest in the process alive in spite of a history of complete failure. Among the most important of these were the following:

First—The improved condition in which the wool was presented to the carding and spinning operations thus resulting in a reduction of the percentage of noils¹⁶ and a corresponding increase in the percentage of tops.

Second—The recovery of the wool grease which is a valuable commercial article for many purposes.¹⁷

Third—Conservation of soaps, alkalies and other detergent substances and the elimination of their expense owing to the fact that the naphtha is practically all reclaimed.

Fourth—Presentation of a simple process of recovering potash salts, whenever conditions might demand, owing to the fact that they are removed by warm water, subsequent to the naphtha extraction, with comparative freedom from other soluble substances.

The problem, however, was one of devising a process and apparatus that would be fire and explosion proof, which would recover within narrow limits all of the solvent and permit the separation of the wool grease.

Believing in the value of the extraction process of degreasing wool by the use of petroleum naphtha if properly carried out, the Arlington Mills, of Lawrence, Mass., during the year 1892 turned their attention to its development and, with the aid of Emile Maertens, a chemical engineer of Providence, R. I., and Wm. D. Hartshorne, then chemist and later agent of the mill, devised and erected in 1896 a plant which without doubt solved the mechanical and chemical difficulties previously experienced.

For twenty-five years such a plant has been successfully operated and the fact that its capacity has been increased several times to meet a rapidly growing business during that period shows conclusively that it has proved to be a satisfactory venture.

In general, the process consists in extracting the grease from the raw wool with petroleum naphtha in specially constructed kiers, then washing the wool with warm water to remove the naturally accompanying potash compounds which are not at all soluble in the naphtha. The process therefore presents the possibility of recovering the potash as well as the wool grease. Several improvements were made during the early years of its application through the experience of operation and further discoveries,¹⁸ but in its final development it is carried out something as follows:

The raw wool in the grease is placed in large digesters or kiers, each holding about 3,000 pounds. These kiers are arranged in batteries of four each and the individual kiers of the battery are so arranged as to work in series with each other or more economically in pairs. As soon as completely loaded they are tightly closed and a fairly high vacuum¹⁹ created within the kiers and the solvent is then introduced at the top of the first kier in the series by forcing or pumping it from the proper storage tank. The solvent can be, if thought necessary for some wools, warmed to a blood heat or a temperature just below 100 deg. Fahr. It is customary to use a solvent for the first treatment which is partially saturated with wool fat from previous use, and for each successive treatment a solvent containing less and less dissolved wool grease, and at the end perfectly clean naphtha.²⁰ Compressed gas is used to force the naphtha into the kier and after the latter has acted a sufficient length of time it is forced out at the bottom of the kier either into the top of the next kier in the series or to its proper containing tank. This operation is repeated as many times as may, for each kind of wool, be found necessary to remove the grease. An hour or less is required for the extraction, and usually not more than two hours elapses from the time the wool enters the extraction plant until it leaves on its way to washers for the removal of the potash compounds. More than 1,000,000 pounds of wool can now be extracted in one week at this plant.

When the extraction process is completed the bulk of

¹⁶ Noils. The technical name of the shorter tangled and broken wool fibers which are combed away from the longer fibers during the manufacture of tops for the production of worsted yarn.

¹⁷ See John W. Russell's article, "The By-Products of Wool Scouring," AMERICAN DYESTUFF REPORTER, Vol. IX, No. 1, Sec. 2, July 4, 1921, page 14.

¹⁸ The following is a list of the patents taken out during the early years of the process:

No. 545,899 dated Sept. 10, 1895
No. 545,900 dated Sept. 10, 1895
No. 615,030 dated Nov. 29, 1898
No. 630,293 dated Aug. 1, 1899
No. 630,294 dated Aug. 1, 1899

No. 630,295 dated Aug. 1, 1899

No. 630,296 dated Aug. 1, 1899

¹⁹ One of the objects of this vacuum is to prevent the formation of air bubbles about the fiber within the rather tightly compressed mass of wool, as such air bubbles would have a decided tendency to prevent the immediate contact of the solvent with all portions of the wool fiber. The process of extraction is thus hastened to a considerable extent, and incidentally a less amount of air is left in the gas receiver system.

²⁰ The process of methodical extraction described in an earlier article is thus applied. See AMERICAN DYESTUFF REPORTER, Vol. VIII, No. 10, Sec. 2, March 7, 1921, page 20.

the naphtha contained in the kier at that time is forced by means of compressed gas into its proper tank for grease recovery or reuse.^{21 22} A rotary pump connected with the bottoms and tops of a battery of kiers circulates gas from and to the gas receiver, thus removing the residual vapors from the kier and condensing them by passing through a condenser which is kept at a low temperature. The gas passing from the condenser goes through a reheater placed in the circuit. This circulation is repeated until the naphtha vapors are condensed sufficiently. A vacuum pump completes the removal of the residual vapors.

Certain remaining odorous impurities are finally removed by blowing ordinary air, or air mixed with steam through the wool, just before the kier is opened.

One of the most important features of the Maertens process, and in fact the one which more than any other has made it possible to successfully carry on the process over a period of a quarter of a century without any serious accident of any kind, is as follows: The whole extraction process, from the time the naphtha is first introduced into the kier until the last traces have been removed, is carried on in an atmosphere of inert gas in a system which is a closed cycle sealed from the outer air.

When this closed system was first devised it was thought necessary to use carbon dioxide, and the large gas holder which constitutes a part of the system was filled with this gas. As time went on, however, it was discovered that under the conditions of use the tendency of the reaction between the naphtha and wool and its natural accompanying substances was to absorb oxygen from any air present and make the mixture sufficiently inert by its relatively greater proportion of nitrogen to avoid danger of ignition from an electric or friction produced spark within the system.

This whole system, as may be inferred from the above description, is therefore a complicated assembly of tanks, kiers, pipes and valves. These, however, have been so ingeniously planned and perfectly installed that insurance inspectors going from one end of the plant to the other can scarcely detect the odor of naphtha; by no means as much as is ordinarily detected in even a well-managed garage.

Another important safeguard against accident is the fact that the whole extraction plant is installed in a special building, the lower part of which is for all intents and purposes an enormous liquid-tight tank. This is so trapped that in case, through accident, any amount of naphtha should escape there would be no possibility of its entering the sewer of the plant or the city. Effective

fire walls also separate this building from the rest of the plant.

EXTRACTION OF POTASH COMPOUNDS AND REMOVAL OF REMAINING DIRT

Upon opening the kier after the extraction process is completed the wool is thrown through doors in the side of the kiers onto a traveling apron or belt conveyer which carries it to the plant where it is washed with water to remove the dirt and remaining potash compounds. Nothing but pure warm water is used, the potassium compounds—some of which are natural soaps—furnishing all of the detergent action necessary.

Special washers, also designed by Maertens, are used for this purpose. These washers differ from the ordinary continuous wool scouring machine in that the wool does not pass through a succession of continuous bowls but through a series of troughs located one above the other. The water solution containing the dissolved potassium compounds may be passed through this machine a number of times and when finally more or less saturated and contaminated by dirt may be conducted to evaporators and the potash compounds reclaimed or, if the market for such compounds is not particularly good or does not seem to warrant their reclamation, the liquor goes to the sewer.

RECOVERY OF WOOL GREASE

The naphtha solution, after it has become saturated with wool grease, is passed to the reclamation stills where the naphtha is distilled off, and returned to the extraction system.

The residual wool grease is passed to the purifying tanks, where it is washed with water, the water being removed by a centrifugal separator. Air is finally blown through the wool grease to thoroughly remove the last traces of water and to eliminate objectional odors.

LIMITATIONS AS TO WOOLS TREATED

It may not be considered economical to degrease all wools by the naphtha extraction method. The percentage of wool grease in commercial wools may vary from a comparatively low figure in the case of mohair and luster wools to as high as 20 per cent or more in certain fine Australian wools. There must be present a certain percentage of wool grease and potash compounds to make it profitable or even advisable to use this process. Wools

²¹ One of Maerten's patents mentions the squeezing of the naphtha from the wool by means of a ram or piston, which fitted rather tightly the cylindrical kier and remained at the top of the kier while the extraction was in progress. This method was intended more for small plants and to prevent possible infringements upon the

process, and as far as the author knows has not been extensively used.

²² This final extracting naphtha is almost clean as far as dissolved grease is concerned and is reused. It is only the naphtha which has become saturated with wool grease after continued use that is sent to the reclaiming still.

too low in either grease or potash cannot be used, if such wools are the only kind consumed. With a sufficient variety in the wools handled their rotation can be so arranged as to permit the excess of potash in some to furnish a proper detergent bath for others which are deficient in this essential factor, if the use of soap is to be avoided.

It is the author's opinion that as time goes on more attention will be paid to naphtha extraction process and that it will be more extensively used, not only for de-

greasing wool, but for the cleansing of woolen and worsted cloth.

In closing this article the writer wishes to state that some of the features which may be quite essential to successful operation are of more recent development than those disclosed by patents and are held confidential by both owners and employees. He is, of course, unfamiliar with details of this nature and has only attempted to deal with the fundamental principles underlying an interesting adaptation of applied science to the ancient operation of wool degreasing.

The Recovery of Caustic Soda

By P. F. ESTEY

Chemist, Bradford Dyeing Association, Bradford, R. I.

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THE disposal of caustic soda washings from the mercerizers is a problem requiring considerable study. In many plants the washings are used for the caustic boil in the kiers, vessels or jigs in order to save the cost of new alkali. Sometimes the washings contain excessive amounts of lime, magnesium or aluminum salts, and have to be discarded or purified. In many towns and cities the textile plants are not allowed to dump large amounts of alkali into the water supplies; therefore the question arises as to the disposition of these chemicals. The caustic soda recovery plant offers a solution of the problem.

WASHINGS

The purity of the washings depends largely upon the condition of the cloth mercerized. It is the usual custom to mercerize after kier boiling. In some instances, however, the cloth is mercerized without any preliminary treatment other than singeing, in which event most of the impurities in the cloth are absorbed in the caustic bowls and the wash boxes. Such washings will be rather unsafe to use for boiling out cotton, owing to the high percentages of impurities they carry and to the tendency to form insoluble soaps, if soaps are used with the caustic.

The following analysis will illustrate the above point. A sample was taken from washings through which kiered and unkiered cloth had been passed—the sample representing the average washings from the mercerizing machine. The analysis was as follows:

Specific gravity (15 deg. Cent.)....	8.700 Tw.
Water (H ₂ O)	95.480%
Total solids	4.520%

Examination of total solids:

Caustic soda (NaOH).....	3.750%
Sodium carbonate (Na ₂ CO ₃).....	0.200%

Sodium chloride (NaCl).....	0.119%
Insoluble matter	0.440%

The insoluble matter consisted of carbonates and silicates of lime, magnesium and aluminum gathered from the china clay with which the warps were sized. There was also a certain amount of suspended organic matter present which came from the singe dust in the cloth. Most of these impurities may be precipitated in the causticization process and the others separate out of the recovered caustic to a certain degree. It may be well to describe here the apparatus necessary for the caustic recovery plant.

GENERAL LAY-OUT OF THE RECOVERY PLANT

Storage Tanks for Washings.—The washings are pumped over to the recovery plant and received in tanks holding about 8,500 gallons each. These tanks (usually four) are on the ground floor of the plant. Two are reserved for washings, and two for the causticized liquor. They are equipped with inlets near the top and triple outlets at the bottom—one to the evaporators, one to the causticizers and a third to the drains. It is customary to allow the washings to settle overnight before pumping up to the causticizers.

Causticizers.—The causticizers are mild steel vats, 8 feet wide by 30 feet long at the top, and are U-shaped. A horizontal agitator with four blades at right angles sweeps the bottom of the tank and keeps the liquor in motion. A syphon pipe is located at one end for lowering the mixing into the storage tank. The mixing is heated to the boil by two open horizontal steam pipes, 2 feet from the bottom of the tank, the steam spraying into the liquor through holes 6 inches apart. Three grates extending 2 feet into the tanks receive the necessary chemicals. An iron-rail fence around the tank serves as a protection against accidents. The

mixing tank holds about 11,000 gallons of washings and is filled to within 1 foot of the top by pumping liquor from the storage tanks by means of a centrifugal pump.

METHOD OF OPERATION

The agitator is set in motion, and after a few minutes a sample of washing is removed from the middle of the tank and tested for specific gravity with an accurate hydrometer. We have found the highest possible mixing strength to be 14 deg. Tw. If the washings test 8 deg. Tw. the batch is brought up to 14 deg. by adding soda ash. Tanks of the size quoted require about 600 pounds of soda ash for 1 deg. Tw. The soda is deposited in the grates, the steam turned on and the liquor heated to about 170 deg. Fahr. The lime necessary to change the soda ash into caustic and precipitate the impurities in the washings is now added and the batch boiled quietly for fifteen to twenty minutes. At the end of this time a sample is removed and examined. If an insufficient quantity of lime has been added the liquor in the pan will remain cloudy for some time, but if the amount of lime is approximately correct the precipitate will settle quickly to the bottom, leaving the clear liquor on top. When this happens a small quantity of liquor is filtered, weighed and titrated with $N/2HCl$ to obtain the ratio of caustic to carbonate. The two-indicator method is sufficiently accurate for this purpose. The ratio should be about 1 part of carbonate to 28 or 30 of caustic. If the percentage of carbonate is greater, more lime is added to the tank, the boiling continued for a few minutes and the liquor retested.

If too much soda is added, the reaction, $Na_2CO_3 + Ca(OH)_2 = 2NaOH + CaCO_3$, becomes reversible and the strong caustic redissolves some of the calcium carbonate. In such a contingency the strength of the liquor must be reduced with water and the batch reboiled with the addition of more lime. When the test proves satisfactory, the agitator is stopped and the precipitate allowed to settle overnight. In the morning the clear liquor is syphoned off and run into one of the storage tanks. The remaining sludge is washed with water to remove its caustic content and the washings are added to the liquor from the mercerizing plant.

If an excess of washings are on hand, or if the mercerizing washings are rather weak, the latter may be added to the sludge and agitated. By so doing the strength of the washings will be increased one or two degrees and the sludge will be washed at the same time. After settling and running down the remaining sludge is washed into the river or into a bed reserved for it. The clear liquor in the storage tank is allowed to settle a few hours and is then ready for the evaporators.

The evaporation of the liquor is carried out in a system of four cylindrical evaporators. The bottom

sections are built up of a number of vertical tubes. The liquor drops into the open tubes, which are surrounded by steam. The upper portions of the evaporators contain the rest of the boiling liquor. The boiling liquor may be watched through glasses about 2 feet long by $1\frac{1}{2}$ inches wide in the center of the evaporators. Catch vessels of about 35 gallons' capacity are at the right of the evaporators, and serve as containers if the liquor boils too high. Live steam causes the liquor in the first evaporator to boil under a slight pressure at about 230 deg. Fahr. Then the same steam passes into the second evaporator, which boils at about 210 deg. Fahr., as it is under a slight vacuum. The third evaporator boils at 200 deg. Fahr., and the fourth at 180 deg. Fahr. A vacuum engine is connected to the No. 4 evaporator and the highest possible vacuum applied. No. 3 is under a reduced vacuum, and No. 2 is slightly affected. The power of the vacuum is shown by the boiling point of the caustic. The evaporators should be well covered with asbestos so that the least possible heat will be lost by radiation.

The causticized liquor is pumped into the No. 1 evaporator until it shows about 2 inches above the bottom of the glass. It is then boiled down until it is no longer visible above the tube. No. 2 evaporator is then filled from No. 1 to the 2-inch level above the glass, and No. 1 is refilled by pumping from the storage tank. No. 3 is filled from the liquor in No. 2 and No. 4 from No. 3. No. 4 evaporator has a small pipe inlet, with a reservoir on the outer end of the pipe. The reservoir has a valve on each end. By shutting the outer and opening the inner valve the reservoir is filled with liquor from the No. 4 evaporator. When full the inner valve is closed, the outer one opened, and a sample withdrawn for testing purposes. When the liquor in No. 4 has reached the desired strength (60 to 80 deg. Tw.) the vacuum is removed and the concentrated liquor pumped into vertical tanks, where it is allowed to cool and deposit any soda impurities that may settle out. A pipe conducts the caustic from these vertical tanks into the mercerizing department.

REDUCTION OF EXPENSE

Although the running expenses of a caustic recovery plant are quite heavy, they may be reduced in several ways:

1. Make the washings as strong as possible without leaving more than a trace of caustic in the cloth.
2. Boil the causticizations with waste steam if an adequate supply is available.
3. Take care that the quantity of lime used is not excessive.
4. Observe that all tanks, pipes, pumps and evaporators are free from leaks or faults.

The establishment of a caustic recovery plant and its intelligent operation will undoubtedly solve one of the vital problems of many textile concerns.

GREASING MACHINERY FOR STORAGE

By CHARLES E. MULLIN

ALMOST every textile plant has at some time or other found it necessary to store various machinery which is either temporarily or permanently out of use. Very often, when this machinery is hauled out of storage for use or sale, it is found to be almost completely ruined by the corrosion due to rusting.

During the war the deterioration of arms and equipment of various kinds due to this corrosion by rust was a serious matter, and the Government spent much time and money in exhaustive experiments with the many mixtures proposed or offered for the prevention of rust. Many almost, or even quite, worthless compounds were offered and tested. Most of this testing was done by the Bureau of Standards, which has now issued a valuable technologic paper, by Walker and Steel, upon the subject of "Slushing Oils."

Many of the mixtures offered were straight petroleum products or blends of the same. Some were petroleum products containing loading materials, such as lithopone, petroleum residue, iron oxide, etc. Petroleum products containing emulsified aqueous sodium chromate solution, or mixtures containing varnish, blown vegetable oils, asphalt materials or asphalt in a solvent thinner, rosin, etc., were also found.

As a result of the work by the bureau, three formulas were developed which have given me such excellent results when used upon textile and other machinery in storage that I believe they deserve a wider circulation. Any of the following may be easily and cheaply prepared from materials found in many plants, or available at the nearest drug store or chemical supply house.

An oil or grease of low melting point may be prepared from the following:

Petrolatum (preferably the U. S. P. grade)	10 Parts
Rosin (preferably H grade)	1 Part
Kerosene or coal oil	1 Part

Melt the rosin and mix with the previously-heated petrolatum. Stir well while cooling, and then add the kerosene. If a more solid grease is desired, a little candelilla wax may be substituted for a part of the petrolatum. The more wax substituted, the more solid the resulting grease. In Government tests this mixture almost perfectly preserved bright steel plates exposed to the outside winter weather for eight months.

Two other formulas are given for semi-solid greases:

FORMULA A

Candelilla wax	3 Parts
Rosin (preferably but not necessarily H grade)	6 Parts
Petrolatum (U. S. P.)	50 Parts

FORMULA B

Carnauba wax	2 Parts
Rosin	5 Parts
Petrolatum	50 Parts

The above materials should be heated together to about 125 deg. Cent. until all the ingredients are melted and the mixture thoroughly stirred while cooling. They are best applied warm so as to completely cover all the surfaces.

I have found these greases especially valuable in preventing rusting of combing and carding machinery, polished rolls from calenders, and other finishing machinery, etc. When it is desired to remove the grease, the machine may be given a scrubbing with gasoline, followed with hot water containing plenty of soap and soda ash. Then rinse and dry in a warm place.

A New Bleaching Process

A NOVEL bleaching composition and a process which can be applied to any textile material is patented in England (146,078) by J. F. King, of Philadelphia. It is claimed to save time and labor, to reduce cost in weight, and to give a dead white when required. Foreign matter, for instance in raw cotton, is removed, and the complete bleaching action takes approximately two hours. It is claimed that frequently there is no loss in weight of the bleached material, and that when any loss occurs it rarely exceeds 2 per cent. The loss in tensile strength is also substantially decreased.

The bleaching compound is a solution containing sodium chloride, a peroxide and Glauber's salt. And to this may be added detergents, such as caustic soda or sodium carbonate. Either hydrogen peroxide or sodium peroxide may be used.

The material to be bleached is immersed in the bleaching solution and boiled and afterwards rinsed.

As an example, the bleaching composition is prepared by mixing:

10 parts by weight common salt
10 parts by weight soda ash
6 parts by weight peroxide of hydrogen
10 parts by weight caustic soda
24 parts by weight Glauber's salt

For 1,004 pounds of the material to be bleached, 60 pounds of this composition is dissolved in 500 gallons of water.

The contents of the vat may be boiled for approximately an hour, after which the materials are rinsed, first in hot water for about five minutes and then in cold water for about five minutes.

If it is desired to dye the materials, the bleaching process may be carried out with about substantially one-half of the quantity of the bleaching composition

(Concluded on page 32.)

AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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FULFILLMENT

BY a happy intermingling of circumstance and design, it is now written that two great scientific Expositions will have marked the official opening and close of what may be termed the crystallization period of the American Association of Textile Chemists and Colorists. The Chemical Exposition in New York witnessed the preliminary gathering, at Rumford Hall, the Chemists' Club, when the project for the first time began to assume tangible form and the decision to organize was definitely taken. It is peculiarly appropriate in a double sense, therefore, that the International Textile Exposition in Boston should witness the consummation of that resolve through the inaugural meeting of the Association on Thursday, November 3, at the Engineers' Club.

The immediate occasion of this inaugural meeting—the precursor, we trust, of an endless chain—was the agreement arrived at in New York. Its true cause, however, arises from the needs of the past, which have grown ever more insistent as the art of coloring textiles has been advanced by science. Lacking such an organization as the one now about to be launched, the American textile industry, no matter how efficient and resourceful in other respects, must always have been incomplete. Possessed of it, its potentialities should be realized to a greater degree than has heretofore been possible.

The necessity of preparing this issue for distribution at the Textile Exposition, and hence well in advance of the Boston meeting, renders anything more than a word or two of congratulatory comment somewhat out of place. Likewise, it precludes the adding of much in the way of further information to that already given last month.

The mechanical details of organization have progressed steadily and with a gratifying smoothness. Of the fact that the Association will be composed of experienced in-

dividuals of high standing, fully alive to the responsibilities involved and the necessity of fulfilling the best traditions of American chemistry, there can be no doubt. Numerous well-attended meetings of the general organization committee and the various subcommittees have been held, and it may be stated in passing that keen interest is being manifested by all concerned, and that many enthusiastic letters have been received by Chairman Louis A. Olney.

Until these subcommittees make their final report at the inaugural meeting, the qualifications for membership will not be definitely known. It is understood, however, that there will be two classes of members, active and junior, and that it is the intention of the committee to propose such rules for membership as will maintain a high standard of scientific and technical ability among active members. The minimum age limit for active members will probably be twenty-six years.

In order that the Association may be duly organized, a number of representative textile chemists and colorists are to be invited to become charter members, and those so invited will constitute the number invited to attend the inaugural meeting.

It is also understood that provision will be made for the formation of local sections, and it is hoped that at an early date such sections will be organized in Philadelphia, New York and Boston, and later, possibly, one in the South. The parent organization, however, is to be made national and not local in any sense of the word.

Now that the successful consummation of this worthy project is so near at hand, and since one of the stated objects of the new Association will be the promotion of research, a point made by Benjamin T. Brooks, of the Mathieson Alkali Works, at the convention of the National Association of Cotton Manufacturers in Boston, becomes a timely and appropriate subject for introduction here. Research, the speaker declared, cannot be done effectively, as some imagine, in the spare time of college professors, whose duties are exacting, nor by students, who are not sufficiently trained to do work of any value. It cannot be left to a committee, and, moreover, research on problems that are worth while should be guaranteed for a period of at least four or five years.

At the same time, technical research is one of the most important paths of industrial progress, and the chief characteristic of modern inventive work is group co-operation and group thinking. Haber and Rossignol had the assistance of the entire Badische Company's organization in their work on ammonia synthesis. The point, therefore, is this: If the central research organization can draw freely upon the knowledge and experience of its members, the net results should be a piece of whole cloth the individual threads of which one would find it difficult to trace.

That was preached to a large gathering of textile men at Boston, and it is being preached elsewhere, continually. It will undoubtedly be made one of the important doctrines of the new Association, for the maximum result is attainable only in that way—which means that the

best gifts within the power of American chemistry to offer are attainable only in that way.

The former tendency toward a too great secretiveness, to mention only one of the many excellent points emphasized by Professor Olney and others at the New York meeting, is to-day giving place to a general willingness to co-operate upon important problems, and the organizers of the Association do well to give this phase of the question due prominence at the very outset.

The AMERICAN DYESTUFF REPORTER regards this inaugural meeting as a most significant and vital event in the history of the textile industry of this country, as well as a long step toward the solution of many annoying problems; and it would add to the host of others its good wishes for the complete success of the Association in all its undertakings.

DYESTUFFS AT THE TEXTILE EXPOSITION

THE International Textile Exposition offers one of the largest and most complete exhibitions of textile and dyeing machinery ever gathered together under one roof. It presents a bewildering assortment of designs, weaves and textures in every conceivable variety of fabric. It illustrates to the visitor all the processes in general use for the production of the materials which cover him by day and by night, keep him warm, beautify him, decorate his dwelling and even provide him temporarily with those dwellings while away from civilization; it displays the multiplicity of uses to which the products of the textile industry may be put. Moreover, rightly considered, it gives to both the casual visitor and to the student of economic conditions an opportunity for a little profound thought.

It shows the dyestuffs with which these materials are colored. Why should the dye industry place its latest achievements on exhibition in company with those of the textile industry? Because the two are wholly interdependent.

Ages ago, it is probable that the covering power of a garment was the principal consideration. If it could be colored, so much the better, yet there is little doubt of the fact that human skins were daubed with variegated clays or plant juices, after the fashion of the American Indian, long before garments of any sort came into general use. But the desire to embellish and, if possible, to beautify, was ever present. Hence, when fabrics first came to be worn, they were stained, and thus what was to become the art of dyeing came into existence and grew until to-day civilization and fashion absolutely demand colored goods, and the textile industry confronted by the prospect of a "white market" could not hold its domestic trade against foreign competitors by means of anything less than a rigid military blockade.

If such a blockade were set up, for reasons of grim necessity, by our own Government, people would make the best of the situation, for all would then be in the same predicament. But what if a blockade against the only country in the world able fully to supply our dye markets

were suddenly set up, without so much as an excuse me, by a foreign power, itself a large producer of textiles? The people would not suffer nearly so much as the textile industry would. Fashion is a ruthless mistress, and has often been known to insist that she be given preference even over patriotism. That is exactly what took place at the beginning of the World War, when the British stopped the German dyes from coming over here.

This should illustrate the folly of any textile manufacturer who would depend upon a foreign source of supply for his dyestuffs when he has the means ready at hand to assure himself a domestic supply, subject to the regulation of no power but the United States Government.

It will be well not to forget, while viewing the Textile Exposition and noting the beauty of the fabrics displayed, that these gorgeous effects are possible only because of the dye industry. Spend, therefore, a little of your time at the booths of the dye manufacturers, hear what they have to say about the one thing necessary to assure their permanent presence in this country, reflect that the measure which they advocate was framed in its final form by dye consumers, not manufacturers—and decide for yourself, once and for all, that as a member of the public whose interests are at stake and whose very national safety is at stake, you will make your sentiments known to your Representative and Senator in Congress, who have spent two years and a half in deliberation on the shallow pretext that you do not know your own mind in this matter.

PROTECTION, THE PARAMOUNT ISSUE

WHEN a question remains before the public over a long period of time, subject to discussion by endless varying interests and factions, and by all sorts of individuals from those high in the Government down to the man in the street, it becomes clarified to a point where there can be no doubt left as to its fundamentals. This is true even when the original issue was once involved and abstruse. It is true in the case of the dye industry.

To-day there is no question in the public mind as to the need of a self-contained American dye industry. The only question which remains is: How shall it be developed?

Seventy-five per cent of the printed comment on the subject these days bears out and reinforces this thought. The clouds have been cleared away so that the opposition to an independent American coal-tar chemical industry is definitely out in the open. It consists of the German propagandists and the importers, both of whom are frankly working for their own interests. Even the opposition among the textile manufacturers is fast disappearing.

Moreover, a careful survey of the House and Senate votes on the different phases of the question indicate that Congress is coming around very rapidly to a realization of the vital needs, both in industry and in chemical warfare, of the dye manufacturer. Outside of a few of

the radical pro-German demagogues, the only opposition left is that group of anti-protectionists who cannot be made to see the value of protection for anything, at any time.

Considered in the light of dollars and cents, the survival or fall of the American dye industry, as an industry, is not vital. But if it be destroyed, it is perfectly plain that dye consumers will again be placed under the complete control of the German trust, the existence of which not even the most emphatic opposer of adequate protection questions, and which can and may choose to throttle our dye consuming industries at any time. The so-called American dye monopoly is a chimera, invented to turn thinkers aside from the original question; the I. G. is a fact.

Von Bernstorff told his Government at the outbreak of the war that by shutting off America's supply of coal-tar dyes, from three to four millions of workers would be thrown out of employment. This was true, and will be just as true in future, if Germany again controls these products. Textile manufacturers know this, and practically all of them are more than willing to make the slight sacrifice of immediate personal interests which is necessary to prevent a repetition of foreign control of their businesses. They realize that it is silly to consider, take chances or even argue about paying a few cents more per pound for dyes just now; that this issue is trivial compared to the possibility of complete dependence upon a powerful combine of foreigners in no way susceptible of control by the United States Government.

The American industry has reached a point where it can produce practically anything necessary to supply the textile manufacturers' needs. When the "industry" consisted only of seven assembling plants for German intermediates, and those intermediates were cut off, the present dye manufacturers came to the rescue, waged brains, energy and capital against a powerful handicap, and succeeded in giving the textile trades something to go on with. These products were far from perfect, but they answered. Since then this exploit, which is typically American, has actually been made a subject for mirth by some opponents of adequate protection, who declare these men merely saw their way to quick fortunes. Nobody who actually put any money into a dye plant, into costly research and experiment, and into a business which offered the difficulties of this one, thought so.

That the dye manufacturers did win out against odds, did aid the American textile trades, and did build up a line of colors which leaves little to be desired, is all the more reason why they should be entitled to proceed with their dearly-won achievement, under the supervision of a Government which is able and ready to prevent them from profiteering, but protected from foreign subsidies.

Protection is the paramount issue. The means to attain it are relatively unimportant. The dye manufacturers have suggested a strictly limited embargo, which received the endorsement of dye consumers, because they could find no other way of dealing with a unique situation. But they do not insist upon anything more than

adequate protection, however accomplished. If some one can write a tariff capable of giving that protection, well and good. The dye men are not embargo-mad, as some would try to persuade the public.

The broad question, upon which all are agreed, is that America needs a coal-tar dye industry of her own. When this question again comes up before Congress, the various men who testified by means of assertions and statements last time will be ready to prove by carefully collected facts the truth of their former statements. It has been proved many times already, but the proof has not been of a nature comprehensible to the lay mind.

This is the supreme factor: Just, impartial, adequate protection for the American dye industry.

How such protection is to be obtained is wholly incidental, and may be worked out to the satisfaction of any or all groups and factions, just so the protection is there.

UNMERITED COMPLAINTS ABOUT AMERICAN DYES

THAT the American public has been sadly tricked into some degree of hostility towards American dyes by unscrupulous individuals who place a few cents of immediate profit above the future welfare of their own business, has been well established. Efforts to trace causes for complaints as to the lack of fastness of dyes to various agents have led, in 99 per cent of the cases, straight back to the manufacturer of the dyed goods.

The true state of affairs is so easily fixed upon, and the truth so simple and obvious, that it will be an impossibility for the public to continue in its error when once definitely apprised of the situation. Then there will be a new deal, and some will either change their business methods or go under.

Proper dyes are available, and can be bought by whoever will. If they cannot be bought from American manufacturers, they can be bought from Germany. There are no obstacles in the way of this, and hence no shadow of ground for the pretext that textile manufacturers cannot guarantee dyed fabrics because American dyes are inferior.

There are plenty of American manufacturers to-day guaranteeing their goods to be of a fastness equal to the identical goods of pre-war days. If these can do so, all can do so. The reason why some do not is shown by the following example:

A textile manufacturer desiring to produce a cheap line of socks takes a sample to a dyer and says to him: "Dye so many pairs of these a good black, which will be absolutely fast as we understand the term, at so much per pound."

The reply is made that maximum fastness cannot be obtained for the price named. The manufacturer is told that Direct Black, at 60 cents a pound, on hosiery looks all right; but that Zambesi Black, or its corresponding type, at \$1.50 a pound, is right.

"Very well, then," says the manufacturer, "give me

something which *looks* all right, which I can sell for so much per dozen pairs."

Then, when the purchaser says the goods are complained of, and even, perhaps, thrown back, this manufacturer wrings his hands, commiserates his disgruntled customer, and asks him what can be expected when one is forced to depend on American dyes!

It is a palpable lie. He isn't forced to depend on American dyes if he can't get what he wants from among them. The present law permits him, and the limited embargo law, if passed, will permit him, to get from any source available whatever he finds unsatisfactory as to price, quality or even delivery. He can get these colors as of right.

But the time has gone by when he really needs to import any considerable portion of his colors. If some manufacturers can obtain satisfactory results with American dyes, so can all. The good American dyes cost more than the poor ones. The same is true of the German dyes, and always has been. The above procedure was often resorted to even in the old days. Goods were then made to be "sold at a price," and always will be. But the manufacturers then did not have the excuse to fall back upon that *American* dyes were inferior. That has been evolved since America began making dyestuffs. The cheaper dyes will always be made, for in the case of some classes of materials, a high degree of fastness is neither required nor expected; they are not meant to be subjected to the same tests and conditions, and hence can just as well be dyed with cheaper colors and a saving effected.

No dye manufacturer would dream of trying to sell Alizarine Red to certain classes in India, for example. With these, it is a question of price and nothing else. The goods are not expected to be "fast." They are cheap goods, dyed by the user himself, who expects to re-dye them several times during the life of the fabric. Congo Red serves his needs and his pocketbook very well.

It is largely the same in America. For certain materials which are not intended to withstand constant exposure to sunlight, perspiration, laundering or any one of half a dozen other fading agents, Congo Red has its uses. But it should not be used on materials competing with goods prepared with Alizarine. And particularly should the manufacturer *not* offer as an excuse, in such

cases, the plea that American dyes are faulty, or that he cannot get the dyes he wants.

American dye manufacturers are always ready to show the manufacturer how to treat his fabrics: they maintain corps of technical men for no other purpose. These men will not only go to the mill, investigate processes and aid the dyer, but will recommend what dyes to use for any given class of goods.

The general rule is that the more violent the tests to which goods are to be subjected, the more expensive the dyestuff required. This obtains all down the line, and it also holds true of German dyestuffs. The relative costs are higher for dyes of great fastness and lower for the more fugitive colors.

Both dye and textile manufacturers understand this condition, but the public, as a rule, does not. To make this truth plain is a task which textile manufacturers, quite as much as dye manufacturers should work to accomplish.

Textile manufacturers as a whole are not guilty of the unfair practices referred to. But it causes a partner of the textile industry, whose best interests are identical with those of the textile manufacturers, to suffer for faults committed by some one else. For their own sakes, the textile manufacturers should help restrain certain among their number from offering this absurd and damaging excuse.

A NEW BLEACHING PROCESS

(Concluded from page 24.)

or mixture mentioned above and for about one-half of the time necessary for a complete bleaching.

The dye may be first prepared by forming a dye paste by mixing dyestuff with a little warm water and then dissolving 4 ounces of this in 2 gallons of cold water. This dye solution may then be added to the cold water rinse and the goods in the vat, and allowed to stand for about five minutes. The contents of the vat may then be heated to about 130 deg. Fahr. and left for about five minutes to produce a light shade of dyeing or for such longer periods as may be required to produce deeper shades. By this method substantially any desired shade may be obtained.

A New Dyeing Machine

By WALTER F. HASKELL

Dyer, Dana Warp Company, Westbrook, Me.

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DYEING as a commercial proposition is very largely a matter of mechanics. Machinery must be provided which will create and maintain the conditions required for the application of suitable dyestuffs

rapidly, continuously and evenly to large quantities of textile material.

In the case of long and short chain warp dyeing the author has made an attempt to improve upon former ma-

chines by the invention of the Haskell Tubular Warp Dyeing Machine. This machine consists of a series of vertical tubes connected with each other alternately at the top and at the bottom with guide rolls journaled in the headers which connect the pipes or tubes. The construction and operation of the machine will be most easily understood by referring to the accompanying drawing.

A supply tank (a) (see Fig. 1) is provided, connected with the first tube. There are squeeze rolls (h) in a splash or overflow tank (a¹) connected with the last tube and a circulation pipe (g) running from the overflow tank (a¹) to the supply tank (a). The whole coil is immersed in a water bath for the purpose of controlling the temperature.

There is also a coil (w) for washing the warp similar to the dyeing coil, except that it is shorter. The wash water flows in the opposite direction to the warp movement so that the warp enters the squeeze rolls from the cleanest water. Provision is made for heating the wash water if so desired. The washing coil is not surrounded by the water bath.

To operate the machine it is necessary to fill the coil with the dye liquor of the desired strength to a level which will partly fill the supply tank and the overflow tank which must be at approximately the same level relative to the coil and above it.

As the warp is drawn along through the tubes by the squeeze rolls it, of course, creates a flow of the dye bath in the same direction but slower. This raises the level of the liquor slightly in the overflow tank, which causes a flow of the dye liquor through the circulation pipe (g) back to the supply tank. The operator of the machine must feed into the supply tank regularly enough fresh dye to keep the bath constantly at the desired strength. Thus the dye liquor, always kept at the same strength, flows round and round through the coil as long as the warp continues to move along, pulled by the squeeze rolls.

During one passage through the machine any particular portion of the warp is submerged in the dye liquor for a period of time four or five times as long as in the ordinary Scotch tub when both machines are driven at the same speed. This prolonged and intimate contact of the yarn with the dye bath while both are in motion promotes good exhaustion of the bath, good penetration and even and well-covered dyeing. The heaviest shades can be easily and economically produced with two or three passages through the machine. The volume of the bath is relatively so small that the amount of unavoidable waste of dyestuff caused by the fact that perfect exhaustion of cotton dyes is very seldom obtained is reduced to the lowest possible minimum. The warp is surrounded by a thin column of dye liquor every portion of which must

come into close contact with the yarn as it passes through the tubes.

In the practical operation of the machine lots weighing approximately 1,200 pounds have many times been dyed in a 100-gallon bath. The machine has the advantage of the "short" or concentrated bath of the Scotch tub and also at the same time the longer time of immersion which larger continuous machines give. The bath is well protected from the air and is not subjected to violent agitation. The warp leaves the dye at its point of greatest exhaustion. This has a strong tendency to prevent "bronzing" and aids washing.

There is no undue strain upon the warp yarn and tangles and breakage are avoided. The machine can be fitted to almost any system of doubling or other manipulation of the warps and requires no special accessory apparatus whatever.

It is evident that the dye liquor becomes exhausted to a considerable degree during its course through the tubes with the warp from the supply tank to the overflow tank. If the rate of circulation be increased by a pump or other means, there will be more dyestuff brought into contact with the yarn during the time of its passage through the tubes and a heavier shade will be produced.

It will be seen to be entirely practical to put the machine on the upper floor of a mill building of ordinary height and to extend the pipes down into the basement, thus securing a depth of perhaps fifty feet. The yarn would then be subjected to a hydrostatic pressure of about twenty-five pounds per square inch at the lowest point of the machine, the effect of which upon penetration and exhaustion would be somewhat problematic but presumably would promote them.

A combination of two or more coils makes an apparatus particularly well adapted to continuous dyeing and to the production of difficult compound shades with only one or two passages through the machine. The accom-

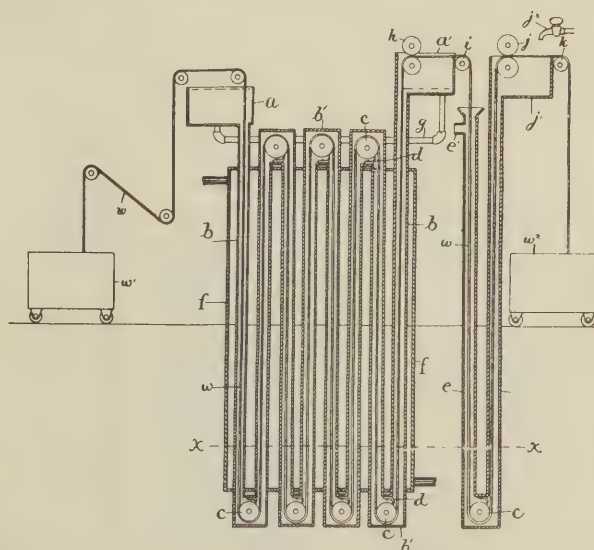


FIG. 1—Diagram of Single-Coil Haskell Tubular Dyeing Machine. See Text for Explanation

panying drawing (see Fig. 2) shows an arrangement designed for this work. (A) represents the machine as already described with the washing coil (3) attached and (B) a second coil exactly like (A) but without any washing action connected. (1) represents the supply tank for coil (A) and (2) is the overflow tank which receives the dye squeezed from the warp after passing through coil (A) by the squeeze rolls (4-4). The strength of the dye bath is kept up by addition of fresh stock liquor made at (5). After leaving coil (A), the warp (6) passes through the washing tubes (3) and is finally delivered into the car (7).

The operation of this part of the machine is exactly as already described. But before the warp reaches coil (A), it is made to pass through coil (B). The warp is taken from the carriage (8), passes through the supply tank (9) of the coil (B), thence through the coil and out through the overflow tank (10) and the squeeze rolls (11), over the guide roll (12) and into the coil (A) through the supply tank (1). A waste pipe (14) leads from the tank (10). The overflow tank (2) is connected with the inlet tank (9) of the other coil by the circulation pipe (13).

Dyeing in this arrangement of two coils in series proceeds as follows: Assuming the apparatus in operation, the both in coil (A) is composed of one or more dyestuffs in sufficient concentration to produce the shade desired in one passage of the warp through the machine. There is a constant flow of the dye bath induced by the motion of the warp, through coil (A), through the circulation pipe (13) to supply tank (9), thence through coil (B) to overflow tank (10), and thence to waste through pipe (14). The strength and volume of the bath must be kept up by the constant addition of stock liquor to supply tank (1). The different coloring matters in the bath are attracted by the fiber at various rates and those for which the fiber has the most attraction will become exhausted in the greatest degree during the passage of the warp. The dye contained in the partially exhausted dye liquor arriving at the overflow tank (2) consists of a larger proportion of the slowly exhausting elements of the colors used and a smaller proportion of

the more rapidly exhausting element than at the supply tank (1). This partially exhausted liquor is conveyed to the supply tank (9) by the circulation pipe (13) and then enters coil (B).

The warp in passing through coil (B) becomes dyed by this liquor from which much of the more rapidly exhausting elements have already been removed in coil (A). Thus, when the warp enters coil (A) it is partially dyed, but has not yet taken up its proper proportion of the more rapidly exhausting elements. When it passes through coil (A) it takes up these and when it is finally delivered to the car (7) the dyeing process is complete and all the elements of the dyestuff have become practically evenly exhausted. The warp is subjected for a longer time to the slowly exhausting elements of the dye than to those more quickly exhausting and, therefore, the dye is practically exhausted in all its parts equally and an even, unvarying, shade is continually produced.

To illustrate: Assume that the machine is in operation, using a mixture of equal quantities of two dyestuffs, No. 1 and No. 2, and that the dye liquor in coil (A) contains five grams per liter of each dye. Assume that in passing through coil (A), No. 1 dyestuff becomes 80 per cent absorbed by the fiber and No. 2 50 per cent. Then the partially exhausted liquor flowing into coil (B) will contain one gram per liter of dyestuff No. 1 and two grams per liter of No. 2. Assuming the absorption of these dyes by the fiber to go on at the same rate in coil (B) as in coil (A), the exhaust liquor flowing to waste through pipe (14) will contain 0-2 grams per liter of dyestuff No. 1 and 0-8 grams per liter of No. 2. Neither dyestuff can accumulate in the bath and a uniform shade will be constantly produced.

It is probable, however, that the dyestuffs will become relatively more completely exhausted in coil (B) than in coil (A), and particularly dyestuff No. 2, which will be present in coil (B) in greater proportion than in coil (A), because the warp will enter coil (B) entirely undyed and, with its absorbent powers at their maximum, and therefore the exhaustion of the two dyestuffs will be equally practically complete for each. If not the addition of a third coil (C) would carry the exhaustion still further. Coil (B) should preferably be shorter than coil (A) and if a third coil (C) be provided it may be still shorter. In those rare cases when a single homogeneous highly purified dyestuff is available an apparatus of this kind probably would not be of advantage as far as uniformity of shade is concerned, but it would aid in complete exhaustion of the color and therefore in reducing costs.

It will be noticed that all dyeing in this apparatus will be done constantly in a new, fresh, bath that cannot become contaminated by old, exhausted, liquors or by the accumulation of impurities that may be found in the dyestuffs or the chemicals used, and which is very unlikely to decompose or change in any way during the brief time while it is in contact with the yarn. This is of considerable importance with certain sulphur, vat and azo colors developed on the fiber.

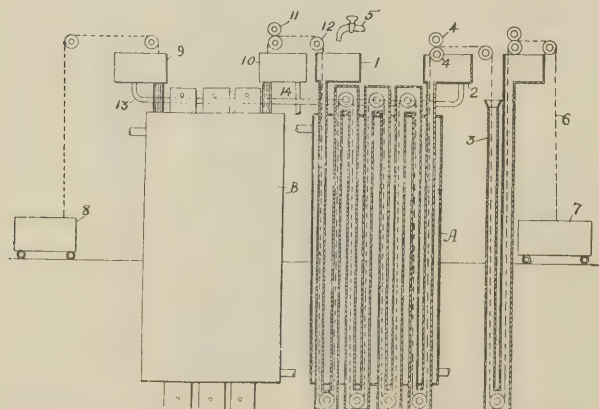


FIG. 2—Diagram of Double-Coil Haskell Tubular Dyeing Machine. See Text for Explanation

It will be noticed that the stock liquor to be added may be as concentrated or as dilute as may be desired. If it be very dilute the excess of water will simply run away through the final waste pipe and will not remain in the machine to dilute the dye bath excessively.

A little thought will show that this machine can be used for piece goods as well as for warps. It will simply be necessary to use very broad, flat, tubes with squeeze rolls of a corresponding width so that the cloth can be run through in open width.

The Control of Bleach-House Processes

Third Paper

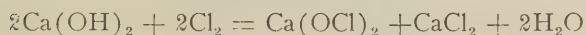
Liquid Chlorine as a Bleaching Agent

By H. W. EASTMAN

FOR many years the universal bleaching agent for cotton, and other vegetable fibers, has been chlorine. The customary method for handling this material has been by absorbing the gas with slaked lime, producing the well-known bleaching powder of commerce.

Bleaching powder is produced by allowing chlorine gas to pass over thin layers of slaked lime, Ca(OH)_2 , contained in lead containers, whereby a more or less stable compound is produced which acts as a vehicle for holding the chlorine until such time as it is desirable to use same.

A good grade of bleaching powder contains 35.5 per cent available chlorine, although some samples contain as high as 40 per cent.



i. e., calcium hydrate + chlorine = calcium hypochlorite + calcium chloride + water.

Bleaching powder is usually considered as consisting principally of a mixture of calcium hypochlorite and calcium chloride and some calcium hydrate.

Bleaching powder, calcium hypochlorite or "chloride of lime" is considered as having a chemical composition represented by either one of the following formulae: CaOCl_2 , or $\text{Ca(OCl)}_2 + \text{CaCl}_2$.

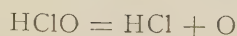
A good grade of bleaching powder consists of a fine dry white powder. It smells strongly of hypochlorous acid, and absorbs moisture from the air. It is more or less soluble in water, but always leaves a considerable amount of insoluble residue.

Bleaching powder decomposes when in contact with the air, due to the presence of carbon dioxide.



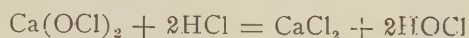
i. e., calcium hypochlorite + carbonic acid = calcium carbonate + calcium chloride + hypochlorous acid.

The hypochlorous acid is not stable and decomposes readily, forming hydrochloric acid and nascent oxygen.

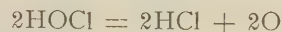


i. e., hypochlorous acid = hydrochloric acid + oxygen.

It is the oxygen, in the nascent condition, which actually accomplishes the bleaching. Mineral acids, added to a bleaching powder solution in small amounts, bring about a rapid liberation of hypochlorous acid, the acid thereafter formed being sufficient to continue the action.



i. e., calcium hypochlorite + hydrochloric acid = calcium chloride + hypochlorous acid.



i. e., hypochlorous acid = hydrochloric acid + oxygen.

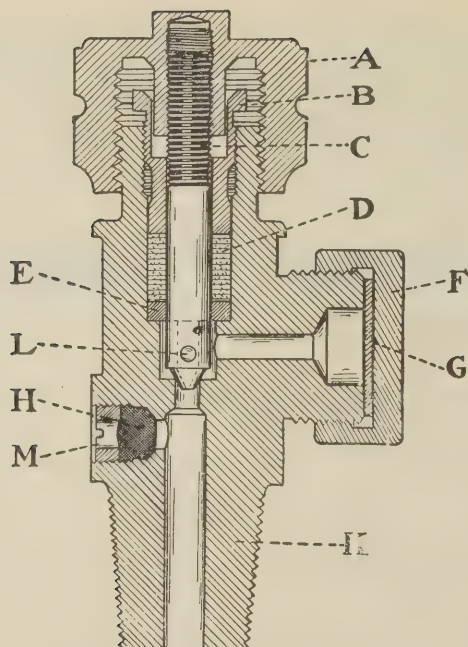
The general procedure for the preparation of bleaching solution from bleaching powder is too well known to require any comment, and it is the purpose of this article to concentrate on the use of liquid chlorine as a bleaching agent for vegetable fibers.

THE USE OF LIQUID CHLORINE

Liquid chlorine, as the name implies, is nothing more nor less than chlorine gas which, under pressure, in proper containers, has assumed a liquid condition. At a temperature of 70 deg. Fahr. liquid chlorine, contained in a cylinder, exerts a pressure of approximately 100 pounds to the square inch.

Liquid chlorine, as offered to the trade, is a remarkably pure, dry substance consisting of 98.80 to 99.99 per cent actual chlorine, together with small amounts of carbon dioxide and oxygen.

Liquid chlorine is marketed in different size steel containers holding 100 and 150 pounds of chlorine. It is also available in containers of 1 ton capacity, as well as in tank cars containing 15 tons of liquid chlorine. The cylinders are provided with a special type of valve which is easily opened at the will of the operator.



A Cross-Section of a W. & T. Type Valve Is Shown in the Accompanying Illustration, the Function of the Different Portions Being Indicated by the Control Letters

A, control handle; B, packing nut; C, valve stem; D, packing; E, packing collar; F, protection nut; G, gasket; H, safety plug; K, valve body; L, pin key; M, safety plug screw.

The end of the cylinder containing the valve is covered by a steel screw cap, which serves as a protection during the transportation and when the cylinder is not in use.

When the valve is opened the pressure is lowered, the liquid chlorine is released and is immediately converted into a gaseous condition, and as a gas is thus available for the preparation of bleaching solution by absorption in the proper reagent.

PREPARATION OF STOCK BLEACH LIQUOR

With the introduction of liquid chlorine for use in bleaching it was customary to prepare the stock bleach bath by allowing the gas to bubble into a soda ash or caustic soda solution, or a mixture of these two chemicals.

A stock bleaching solution prepared by dissolving 35 pounds of 58-degree soda ash, 10 pounds of liquid chlorine and 45 gallons of water produces very satisfactory results, but is not stable and should not be kept for more than one day.

A solution prepared by dissolving 20 pounds of 58-degree soda ash, 8 pounds of 76-degree caustic soda, 10 pounds of liquid chlorine and 45 gallons of water is quite stable, due to the presence of the caustic soda, it being possible to keep such a solution for three or four days.

Ever since the introduction of liquid chlorine some such formulae as the foregoing have been used for the preparation of the stock bleach liquor. Many mills

are, at the present time, making use of liquid chlorine with very satisfactory results, preparing their stock bleach liquor in accordance with the above procedure.

PREPARATION OF STOCK BLEACH LIQUOR, USING CONTROL APPARATUS

An excellent apparatus for the preparation of bleach liquor from liquid chlorine has recently been devised by the Wallace & Tiernan Company, Inc., of Newark, N. J.

The control apparatus referred to consists of an arrangement whereby the liquid chlorine may be rapidly withdrawn from the cylinders without freezing, the liquid chlorine, as well as the absorbing liquid, being automatically measured and controlled as to rate of flow. The chlorine and the liquid used for absorbing same are combined under pressure.

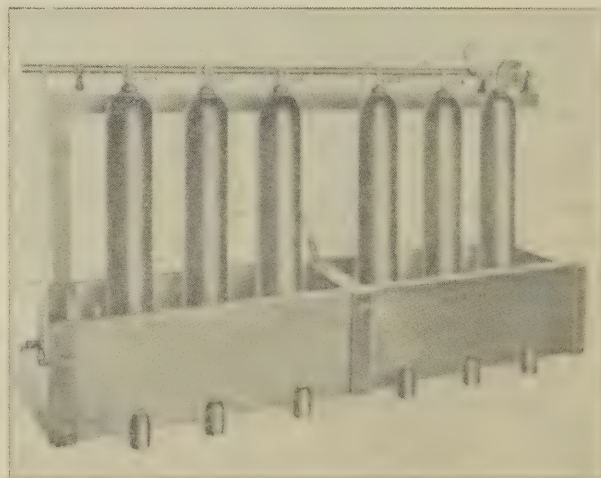
One of the difficulties encountered heretofore in the use of liquid chlorine has been the tendency of the cylinders to freeze upon the release of the chlorine. This was occasioned by opening of the valve, whereby pressure was released, the liquefied chlorine was converted into a gas, during which process a decided lowering of the temperature occurred, oftentimes sufficient to cause the chlorine to congeal, with the subsequent diminishing of the rate of flow.

Evaporator.—This condition can now be overcome by placing the chlorine cylinders in a Wallace & Tiernan evaporator consisting of an arrangement for holding the cylinders in water heated through an automatic steam valve controlled by a thermostat.

The chlorine cylinders are connected by a valve-fitted manifold, a reducing valve and pressure gauge controlling and registering respectively the rate of chlorine flow.

The accompanying cut, furnished by courtesy of the Wallace & Tiernan Company, Inc., illustrates the evaporator, for use with standard 100 or 150 pound cylinders.

The Control Apparatus.—The control apparatus, as illustrated, is operated as follows:

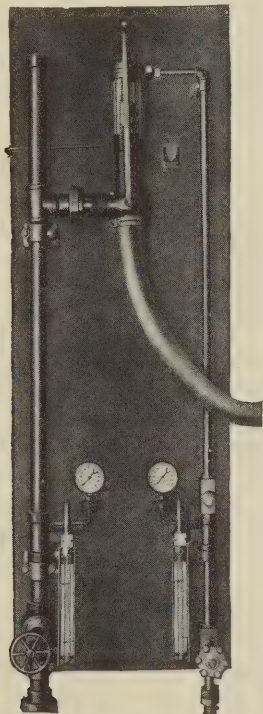


Liquid Chlorine Evaporator

The constant density of chlorine gas is provided by pressure-reducing valve on evaporator, the chlorine being piped to right-hand side of apparatus, passing through shut-off valve, after which it enters a Venturi-type meter and passes to the control valve, which once properly regulated needs no further adjustment.

As the chlorine gas passes through the meter the pressure is shown on a special gauge.

After leaving the control valve the chlorine gas, passing through a check valve, enters an injector and



Photograph of Control Apparatus of Which Diagram Is Shown at Right

is combined, under pressure, with the solution which is to act as a medium for holding same.

The solution to be used for combining with the chlorine gas is pumped, under pressure, through pipe on left of control apparatus, passing through regulating valve, the pressure of solution being shown by gauge.

The valve regulates the flow of the solution, which is indicated by manometer connected with Venturi tube. The pressure of the solution is shown on a special gauge.

The bleach solution, consisting of the properly combined chlorine gas and the absorbing liquid, then passes through a pipe line into the storage tank, from whence it may be drawn to the bleach vats.

The liquid used for absorbing the chlorine gas may consist of soda ash or caustic soda, or a mixture of these two chemicals. Milk of lime may also be employed. The soda ash or the caustic soda upon mixture with liquid chlorine yields sodium hypochlorite, the caustic soda yielding the more stable solution. Sodium hypochlorite upon textile material yields a perfectly soft bleach, while the milk of lime forms cal-

cium hypochlorite and produces the same type of bleach as is obtained with the bleach liquor produced from bleaching powder.

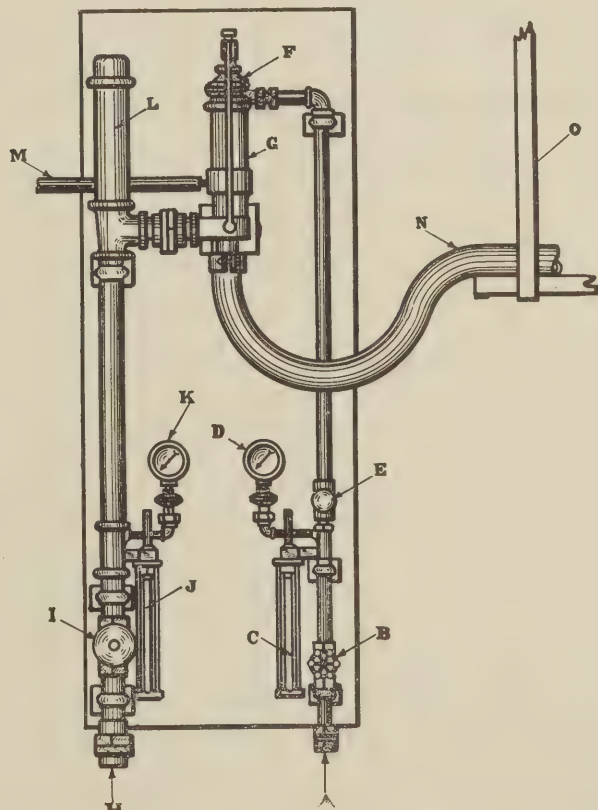
A suitable solution for use with the control apparatus may be prepared by dissolving reagents in the following proportions: Twelve pounds of caustic in 45 gallons of water, which mixture will absorb 10 pounds liquid chlorine and produce a solution which is just barely alkaline to phenol-phthalein test solution, and one which is almost immediately available for dilution to proper strength for bleaching.

Such a stock solution contains approximately 2 to 2.5 per cent of available chlorine, corresponding in strength to that of a 7 to 8 deg. Tw. solution prepared from bleaching powder.

ADVANTAGES DERIVED FROM USE OF LIQUID CHLORINE

The use of liquid chlorine for the preparation of a bleach bath possesses decided advantages over the use of bleaching powder, among which may be enumerated the following:

1. A decided saving in freight charges, the liquid chlorine always being in a pure concentrated form;



"W. & T." Control Apparatus for Manufacturing Bleaching Solutions from Liquid Chlorine

A, chlorine inlet to control apparatus; B, chlorine shut-off valve; C, chlorine flow meter; D, chlorine back pressure gauge; E, chlorine control valve; F, chlorine check valve; G, injector; H, solution inlet to control apparatus; I, solution control valve; J, solution flow meter; K, solution back pressure gauge; L, compression chamber; M, vacuum relief line; N, bleaching solution discharge; O, support for discharge line.

whereas, under ideal conditions, bleaching powder must always be held in bulky containers.

2. The saving in time and labor is considerable, as the handling is reduced to a minimum. It is only necessary to properly set the chlorine cylinder and open a few valves, whereas in preparing solution with bleaching powder it is necessary to handle heavy containers which have often become damaged in transit or have decomposed due to long storage. Bleaching powder must be properly ground in a mixing machine with water, after which it is diluted and allowed to thoroughly settle, when the supernatant liquor is drawn off, considerable chlorine being lost in the settled portion.

3. Liquid chlorine is stable and can be stored for an indefinite period of time, whereas bleaching powder deteriorates rapidly in strength.

4. Absence of insoluble salts of calcium, which in contact with textile material are very apt to cause weakening and harshness of the fabric.

5. Material which is to be dyed on a bleached base would take the dyestuff more evenly than in the case of goods processed with the lime bleach.

6. Solutions prepared from liquid chlorine do not exert such a deleterious action upon colored stripes or pattern effects contained in cotton piece goods as does a corresponding solution of calcium hypochlorite.

HANDLING LIQUID CHLORINE

A Paper Read Before the National Safety Council Congress

By D. K. BARTLETT

Vice-President, Electro Bleaching Gas Co.

CHLORINE in liquid form has now been used in this country since 1907. In common with all other compressed gases there are very definite and careful regulations drawn by the I. C. C. governing its transportation. Under these regulations there are four accepted containers in which the material may be moved, namely, those which carry 100 pounds, 150 pounds, 2,000 pounds, and 30,000 pounds. As there have been no accidents in interstate commerce since the regulations have been in force it would seem proper to assume that the regulations are right, as they now stand.

The use of chlorine has become very widespread through the textile industry, the public water supply system, the flour industry, the chemical industry, and the pulp and paper industry. Liquid chlorine is to-day stored in from 4,000 to 5,000 different points in quantities of from a few cylinders to many thousand pounds. So far such regulations covering storage as have been in force are simply those recommended by the producer to the consumer. Safety is of prime importance to the producer as well as the consumer, and while the hazard is much less than is commonly supposed, it is, nevertheless, sufficient to cause the producers to adhere to and

recommend regulations which make the use of this material safe.

It may be well at this point to consider briefly the hazards of compressed gases in general.

As long as the gas remains in the container, it is obvious that it can do no harm, irrespective of its effect when released. It is therefore necessary to consider the probability of escape of gas from the container, as well as the qualities of the gas itself. An escape of gas from a container may be due to:

(a) A true explosion.

(b) An increase of pressure, due to heat, sufficient to rupture the container.

(c) Leaks.

If the gas escapes from the container, the resulting hazard may be due to:

1. Inflammability.

2. Poisonous effects.

3. Irritating effects, with interference with sight or respiration.

Considering now the specific case of chlorine, we can eliminate (a) since it is non-explosive. The chance of a rupture due to (b) is very slight on account of the high critical temperature of chlorine. The following table gives this temperature for a number of common gases:

Chlorine	146
Ammonia	132
Acetylene	36.5
Nitrous oxide	36.5
Carbon dioxide	31
Oxygen	—118
Hydrogen	—240

By I. C. C. regulations all cylinders and ton drums are provided with fusible plugs which melt at 158 deg. Fahr., at which temperature the pressure is about half the test pressure of ton drums at time of manufacture and a quarter of the test pressure of the smaller cylinders.

There has never been an instance of bursting of a container in transit, or in a user's plant.

There have been four or five cases of the rupture of containers in the manufacturer's plant due to the presence of foreign material in the container which reacted with the chlorine. To guard against a repetition of such accidents, all manufacturers now have in force a rigid system of inspection of empty containers. Even should a container with such foreign material be filled, any trouble resulting will necessarily develop within a few hours, so that any hazard existing from this cause concerns only the manufacturer—not the user or the carrier.

There have also been a few cases of fire where a large quantity of chlorine has been stored. In each case the upward draft due to the heat of conflagration has been strong enough to carry the gas upward and cause a suffi-

cient dilution so that the fire fighters were caused no inconvenience in their work.

This brings us to leaks. Here the evil smell of chlorine is its own greatest safety factor. Its presence in the atmosphere can be detected in very minute quantities through the sense of smell. After the person in charge of the use of the chlorine in any plant has had his first considerable whiff, he is quite ready—from then on—to exercise reasonable care, take necessary precautions, and follow the instructions laid down by the manufacturer.

The next safety factor is the slow absorption of the heat necessary to evaporate the liquid into a gas. The following table gives the rise of temperature of the liquid chlorine in a tank car during a period of ninety-six hours:

Time	Temp. Contents	Change During Period	Pres- sure	Change During Period
(Start)	(—9 deg. C.)	. . . . .	(64 lbs.)	. . . . .
End 24 hrs.	—2 deg. C.	7 deg. C.	76 lbs.	12 lbs.
End 48 hrs.	+3.5 deg. C.	5.5 deg. C.	88 lbs.	12 lbs.
End 74 hrs.	+6 deg. C.	2.5 deg. C.	93 lbs.	5 lbs.
End 96 hrs.	+8.5 deg. C.	2.5 deg. C.	98 lbs.	5 lbs.

When the odor of chlorine is noticed the source should immediately be located. Never hunt a leak through the sense of smell. Always have a gas mask handy and be sure you have fresh canisters. The mask is not apt to be used, but it gives confidence to the one hunting the leak. Have a bottle of aqua ammonia and a piece of waste fastened to the end of a short stick. Dip the waste into the ammonia and start your search. The moment you come to chlorine in the air, a white fume of ammonium chloride will appear. As you reach a denser volume of chlorine, the white fumes are denser. Thus the leak is quickly located. If this leak is in the piping, etc., shut off the valves at the containers and repair. If in a valve on the container or the container itself, and it cannot be stopped, connect the gas valve from the container to your absorption system and begin to operate. The liquid cannot evaporate in the containers, without the application of heat, as fast as the gas is absorbed in your system, and thus the leak quickly stops.

As to the properties of chlorine, it is non-inflammable, and not poisonous, in the sense that carbon monoxide or phosgene, for instance, is poisonous. We can therefore eliminate Nos. 1 and 2, and confine ourselves to No. 3.

The immediate result of inhaling a large quantity of chlorine gas is the inflammation of the tissues lining the throat with resulting coughing and nausea. While it is highly irritating and extremely uncomfortable, it is never fatal—unless the subject remains for a considerable period in an atmosphere of highly concentrated gas.

Should a person be affected by chlorine gas we recommend the following treatment: Remove at once to the open air and away from all gas fumes. Place the patient flat on his back with head slightly elevated, and give a

half teaspoonful of essence of peppermint, or a moderate dose of bromo seltzer or whiskey. This will relieve the tendency to cough and soothe the inflamed membranes, allowing the passage of air and promoting the action of the respiratory organs. The person affected should himself resist as much as possible the impulse to cough. A mustard plaster on the chest will give prompt relief. While there are never any serious after-effects, a physician should always be called.

As this discussion is before the Pulp and Paper Section, we can safely assume that we are preparing to store a considerable quantity of chlorine. First let us discuss storage in either cylinders or ton drums.

The storage space should be selected with an eye to easy unloading and transfer to the absorption room. Either of the smaller cylinders may be readily unloaded from a car and rolled over a floor by one man, but if possible, overhead trolleys should be installed for carrying them. They are suspended from the trolley by a chain block and grasped by a pair of tongs made especially for this purpose. Cylinders are usually handled and stored in an upright position. Ton drums are shipped in gondola cars, each drum resting in a cradle. In unloading them it is therefore necessary to lift the drum clear of the car by means of a chain block and crane or similar device, after which it may be conveyed to the absorption room by either rolling over a level floor or track, or carried by an overhead trolley or industrial car. Ton drums are always used and stored in a horizontal position. The storage had best be under a roof but without sides on a concrete floor above any possible flood line. It would hardly seem necessary to enclose the storage space to protect against unauthorized handling of the cylinders.

The large user will wish to receive this material in the 30,000-pound container, which is permanently fastened to a standard freight car and thus becomes a tank car, and so freight is paid only on the contents. This means a very large saving in the delivered cost of the bleaching material. Thus far the major portion of the material moved in tank cars has been delivered from the car directly into the absorption system, the cars in many cases being emptied in from four to six days. Here again is a marked reduction in cost due to elimination of handling charges.

Mills using liquid chlorine, who can take tank car deliveries, should face the storage problem. There are two methods open. First, the filling of the 2,000-pound container or the so-called ton drum, or fixed tanks large enough to take one tank car only. Both methods are now being installed for the purpose of getting comparative data.

In our opinion, the local conditions affect this problem so that a detailed discussion of the best method of storage is useless—at least at the present state of the art. The problem is, however, one which can readily be worked out for any particular case.



MEN OF MARK in the DYESTUFF FIELD

ARTHUR E. HIRST
Chief Chemist
American Printing Company
Fall River, Mass.

ARTHUR E. HIRST was born at Hartford, Conn., on May 5, 1889, and seven years later his family moved to Boston, where he received his preliminary education in the public schools of that city. On graduating from the Boston English High School he became a rodman and instrument man in the engineering department of the New York, New Haven & Hartford Railroad. In 1909 he entered the Massachusetts Institute of Technology, where he took up the regular course in chemistry and related subjects. In 1913 he graduated with the degree of Bachelor of Science.

Immediately after graduation he entered the employ of the American Printing Company, at Fall River, as chemist. Here his activities included the installation of a laboratory for the testing of materials used in the works, and the solution of various problems incidental to the business. In 1916 he was appointed chief chemist and assistant superintendent under the able training of Joseph H. Hindle, superintendent, and throughout the war he was actively engaged on the multitude of problems connected with the production of dyed goods for the Allied armies.

Mr. Hirst is a member of the American Chemical Society, the Alumni Association of the M. I. T.; the Technology Club, of Fall River; King Philip Lodge, A. F. & A. M., and other Masonic bodies.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

C. C. D.—*Question:* Will you please give me full information regarding the processes by which men's hats are dyed?

Answer: From the dyer's point of view, men's hats divide into three classes, viz.: stiffened fur-felt bodies, soft fur-felt bodies, and wool bodies. The stiffened bodies contain shellac, the soft fur bodies only contain the carroting material, which has little or no effect on the dyeing, while the wool bodies are strongly acid on account of the acid-fuling process. The fur felts are harder and denser, and much more difficult to penetrate; hence different methods must be used for all three classes.

Stiff hats do not need to be fully penetrated, as the edges are always bound with ribbon; but the color must be deep enough to withstand the pouncing operation—i. e., the removal of the rough surface fur by sandpaper to give a smooth finish. The first step is to boil the stiffened bodies for at least an hour in pure water so that the shellac is softened and the felt is wet throughout.

The dyeing, usually black, is done in jacket kettles with about 10 to 15 per cent of an after-chrome black and 25 per cent of Glauber's salt. They are boiled one hour without the addition of any acid, then for another hour after adding 6 per cent acetic acid (28 per cent), and later for half an hour after adding 2 per cent bichromate of soda. This procedure generally gives the desired results, but it is important that the black dye is a true jet tone and not a reddish nor a greenish tone. A black that dyes a good jet black on wool yarn may dye felt differently by allowing the blue-black element to penetrate and leaving an excess of yellow or red on the surface. All dyes in the mixture must penetrate equally well.

Soft fur felts are also boiled out for an hour before dyeing. They are dyed with acid dyes having special level dyeing and penetrating qualities and, of course, very good fastness to light. The dye bath should contain about 25 per cent of Glauber's salt (calculated on the weight of hat bodies to be dyed). More Glauber's salt will open the felt and favor penetration, but the final result will be a soft, flabby felt that will not make

a good hat. The exact amount of Glauber's salt for any particular felt is a matter of experience for the dyer to decide.

The bodies are boiled one hour in the dye bath without acid, then 3 per cent acetic acid is added every half-hour and the boiling continued until a cutting near the edge shows complete penetration. When the penetration is complete, 2 per cent of sulphuric acid may be added to set the dye completely. Rinse clean and dry.

Acetic acid is used even when a dye like Wool Green S is employed, although it is well known that it requires sulphuric acid to exhaust it.

Wool felts are easier to penetrate, but the acid already in the wool causes the dye to set firmly on the surface and would require hours of boiling with Glauber's salt to carry it to the center of the felt. However, by adding about 10 per cent of acetate of soda to the dye bath the sulphuric acid in the wool is replaced by acetic acid and the dyeing proceeds slowly and evenly. Wool felts are mostly used for women's and children's hats and only for the cheapest grades of men's soft hats.

S. W. M.—*Question:* Can you give us any information regarding copper streaks on goods caused by contact with whizzer baskets in hydro extractor?

Answer: While it is claimed that the addition of ammonium sulphocyanide to the dye bath will prevent the action of copper on a dye, it is of no value in preventing the spots caused by contact after rinsing. You may be able to keep clean sheets for lining the whizzer basket, but they need frequent washing in soda or they will cause the spots themselves after a time. The interior of the basket may be painted with white enamel, but the best remedy is to have your dyestuff dealer supply you with colors that are not affected. Such dyes are now obtainable, made in America, and are the best solution of the problem.

L. O. R.—*Question:* In dyeing a sulphur blue on cotton stock in a vacuum machine I lose so much color on rinsing that the center of the batch, not the outside, is very pale. What is the remedy?

Answer: The dye bath always contains an excess of sulphide, and when you begin to rinse the fresh water is able to use this sulphide to strip off some of the color that was dyed on the fiber, as it is still in the reduced condition (almost colorless). The outside of the batch takes all the dissolved air out of the water and oxidizes blue and remains on the cotton. One remedy that has been suggested is to rinse with salt water until the sulphide is all out, then allow the stock to oxidize in the air. A better remedy is to use a direct sulphur blue which does not require oxidation.

Review of Recent Literature

Bleaching Fabrics Containing Colored Effect Threads. British Patent 165,198, issued to the firm of Lumsden & Mackensie, and Morris Fort, M.Sc.

This patent describes an improved process of scouring and bleaching cotton or linen yarns, or fabrics containing dyed-effect fibers or threads, whereby the difficulty of avoiding bleeding and staining during the process as carried on with alkaline solutions is very largely overcome. In only comparatively few cases among the dyed colors used to withstand bleaching, with the exception of a few insoluble azo dyes and indigoid vat dyes, will solvent extraction with organic solvents such as benzol, naphtha and benzine, hot or cold, seriously affect the color of dyed fibers or threads. Other solvents also may be used—as, for example, alcohol and chlorinated hydrocarbons—but these latter are more likely to affect the dyed shades than the hydrocarbon solvents. The process, therefore, begins with the extraction of the goods in bulk with a volatile or organic solvent, whereby are eliminated from the fabrics substantial amounts of impurities, chiefly oil, fat, wax and allied matter, for the removal of which alkaline scouring or boiling has hitherto been applied.

The extractions of solvents may be carried out by means of any known method or apparatus, and the solvent employed recovered, as well as the extracted oily, fatty and waxy matter, by steaming, distillation and other known means of recovery. After this, a much shorter or milder scouring with alkaline solutions than is usually required, or than is otherwise proper to attain, in conjunction with subsequent bleaching, satisfactory purity and whiteness, can be given to the goods—as, for example, boiling without pressure where otherwise pressure is required, or saturation with hot, weak alkaline solutions by running through a machine, or by passing hot alkaline solutions through the goods instead of boiling with alkali; or sodium carbonate may replace the use of caustic soda or lime, or caustic soda the use of lime.

Dyed effects in cotton and linen goods intended to undergo scouring and bleaching will very rarely withstand, without alteration, the most effective alkaline scouring treatments such as can safely be given to ordinary goods when dyed effects are not present—such treatments, for example, as boiling in a kier for upwards of eight hours under pressure with lime or caustic soda. With less severe scouring treatments the dyed colors in use vary widely in the degree of severity which they can withstand, and for this reason the scouring agent, temperature, concentration and time of treatment require variation in order to obtain the best results in each case.

After submitting the goods to solvent extraction, the alkaline scouring treatment which follows is varied, therefore, for different dyed effects. In all cases a suffi-

ciently safe alkaline treatment is used to obviate the liability of bleeding and staining. An example given is that of cotton piece goods containing woven stripes dyed with Indanthrene Blue GCD. The goods may be extracted with hot benzol in any usual manner and the solvent removed by steaming and condensation in a few minutes' time for a small bulk of material, but may require up to twelve hours when the quantity consists of two tons or more. The goods are then treated either in the same vessel or in an open kier with 1 to 2 per cent sodium carbonate solution, hot or boiling, for six to eight hours without pressure. The subsequent bleaching treatment may consist, among others, of scouring with 1 per cent sulphuric acid solution, chemicking with $\frac{1}{2}$ to $\frac{3}{4}$ deg. Tw. bleaching powder solution, and again scouring as before, washing between the operations and at the end. A good white is generally obtained, but in the case of exceptionally difficult goods the bleaching treatment may be repeated with or without scouring again with sodium carbonate.

Introduction to Textile Chemistry. H. Harper. New York: Macmillan & Co.

For the beginner or student. The classes and characteristics of textile fibers are dealt with separately, and excellent diagrams and tables indicate their properties. The various treatments to which vegetable and animal fibers are subjected are fully described and reasons are given for their application. The different kinds of artificial silk are enumerated in tabular form, showing their characteristics. Examples are given of the behavior of various fibers toward a number of treatments, while a set of questions at the end of each chapter is given as an incentive to intelligent reading. The author is a teacher possessing twelve years' experience with students preparing to enter the textile chemistry field, and this little volume should form an excellent textbook for use in classes consisting of part-time workers, as well as students generally.

Pigment Dyestuffs Derived from Tannic Acid and Some Aromatic Amines. Arthur Ernest Everest and Archibald John Hall. "Journal of the Society of Dyers and Colourists," September, 1921; p. 227.

Authors show that cotton mordanted with tannic acid, or with tannic acid and tartar emetic, gives brown to yellow-brown shades when treated with diazo compounds; this being confirmation of German Patent 55,837.

Similar dyeings are produced if gallic acid replaces tannic acid in this process.

The fastness of the dyeings is not greatly affected if the tartar emetic is omitted.

The dyeings obtained with benzedine, tolidine and dinasidine possess the best fastness, followed by those

from the naphthylamines; those from the benzene derivatives are least fast.

When only one of the amino groups in benzidine is diazotized, dyeings are obtained in shades of brown which can be diazotized and further coupled with other components, whereby shades are varied.

Diazotized amines are capable of coupling with oxidized cellulose, but not with cellulose.

Brown pigments may be produced by coupling diazo compounds with tannic acid or gallic acid.

Dyeing Cotton Fabrics in the Sizing Bath. Raffaele Sansone. "Canadian Textile Journal," September 13, 1921; p. 492.

Direct, basic, acid, sulphur, vat and ice colors can be employed for this method, which produces effects not very fast to washing, or very bright; but which, however, fulfill many requirements of the day.

The preparation of the padding bath for direct colors is accomplished as follows: 500 to 600 parts direct dye such as Benzopurpurine 4B, Chrysophenine, Clayton Yellow, Direct Sky Blue, Direct Orange Brown, Direct Brown, etc.; 2,000 parts Turkey Red oil (for light shades only); 200 to 600 parts phosphate of soda; 20,000 parts Dextrine, or starch paste; water necessary to bring whole to 100,000 parts. The goods are treated from one to several times on the padding machine with this paste, according to the shade to be produced.

Another recipe for direct colors is: 150 parts British Gum, to which is added 490 parts water to make a uniform, half-transparent paste; 200 parts tragacanth mucilage, 6 per cent; 40 parts direct cotton dye; 40 parts phosphate of soda; 30 parts glycerine; 50 parts Turkey Red oil, 50 per cent. After padding with this paste the goods are steamed for one hour, dried and finished.

For basic dyestuffs, which produce the brightest effects and are often employed for very light mousselines, voiles, tulles, crepes (crimped goods), etc., the paste may be made up as follows: 2 to 5 parts basic dyestuff is dissolved in a solution containing 2 parts tartaric acid solution (1 part acid to 1 part water), 1 part chlorate of soda, 20 parts water and 20 parts acetic acid, 6 deg. Be. This is then incorporated in 150 parts suitable starch tragacanth or starch dextrine thickening and 700 parts water, to which is then added 25 parts tannic acid solution in acetic acid (1 part of first in 1 of second). The cotton cloth is padded with this bath, dried, steamed twenty minutes, again dried, and finished.

Recent Patents

Dyeing Machine

(1,389,444; August 30, 1921)

JAMES A. GRUNDY (assignor to John Bromley & Sons, Inc., Philadelphia, Pa.)

This consists of a machine for dyeing yarns and the

like, comprising in combination an open-top container, rectangular in contour, for dye liquor; an interior tank of equal width but lesser length mounted within and below the plane of the open top of the container and in spaced relation thereto at each end and at base, the interior tank having a perforated bottom wall; perforated tubular means within said container arranged to apply fluid pressure to circulate the contained dye liquor, and vertically movable means to suspend yarns and the like in the interior tank, these means including parts adapted, when in lowered position, to rest on the edges of the container and close same without closure of the interior tank relatively thereto.

Textile Product Derived from Animal Fiber, and a Process of Making Same

(1,389,274; August 30, 1921)

WILHELM HELMUTH SCHWEITZER (assignor to Society "Technochemia" Aktiengesellschaft, Glarus, Switzerland)

This process consists substantially in treating an animal fiber successively with an oxidizing agent and an excess of alkali, and impregnating the fiber finally with a waterproofing and softening substance.

Dyestuffs, and Process of Making Same

(1,387,596; August 16, 1921)

GUILLEAUME DE MONTMOLLIN and HEINRICH JOSEPH SPIELER (assignors to Society of Chemical Industry in Basle, Switzerland)

This process for making new dyestuffs consists in reacting with a tetrahalogenmethane on an alphanaphtholic compound having its 4-position not substituted, in the presence of an agent capable of combining with acids, and of a catalyst.

Manufacture of Artificial Silk

(1,387,882; August 16, 1921)

EMILE BRONNERT

This process for making artificial viscose silk comprises treating viscose in a precipitating bath comprising a solution of sodium benzene sulphonate and sulphuric acid monohydrate.

Diazo Dye

(Reissue 15,182; August 23, 1921)

WALTER M. RALPH (assignor to National Aniline & Chemical Co., New York City)

The diazo dye described is obtainable by diazotizing 1-amino-4-nitro-naphthalene-6 (or -7) monosulphonic acid coupling with m-amino-p-cresol methyl ether, again diazotizing and coupling the diazotized intermediate with 2.8.6. amino-naphthol sulphonic acid, and reducing the nitro group; the dye, in the form of its sodium salt being a bluish black powder, soluble in water to give a blue solution from which hydrochloric acid produces a blue precipitate, and soluble in concentrated sulphuric acid to

give a greenish blue solution. The product dyes cotton, wool, silk and other fibers, bluish shades which can be developed to give fast blue-black to green-black shades.

Method and Means of Producing Artificial Silk

(1,389,517; August 30, 1921)

ISADOR KITSEE

An improvement in the art of producing artificial silk which consists in exerting a pressure on the produced thread during the time that said thread is carried through the coagulating bath.

Silk-Throwing Machine

(1,390,081; September 6, 1921)

PAUL HYDE BONNER (assignor to Stehli Silks Corporation, New York City)

This is a silk-throwing machine comprising twisting means for twisting at least two silk ends together to form a low twist thread, take-up rollers for taking up and imparting a traveling motion to the threads, means for operating these rollers at considerably less speed than that of the twisting means, twisting and winding means receiving the thread from the take-up rollers and twisting it to form a high twist thread and winding it onto a spool, and means for operating the twisting and winding means at considerably greater speed than the low twisting means.

Process for the Manufacture of Naphthalene Sulphonic Acids

(1,390,241; September 6, 1921)

JOSEPH A. AMBLER and HARRY D. GIBBS

This is a continuous process for the manufacture of sulphonic acids of naphthalene by causing the vapors of naphthalene to come into contact with a descending current of sulphuric acid.

Yarn-Winding Machine

(1,389,392; August 30, 1921)

LOUIS STOCKER

The machine in question comprises a reciprocating member, a rotatable wheel carried thereby and having openings therein through which the yarn passes, an annular rack connected with the wheel, a rack bar with which the annular rack engages in the reciprocation of said member, an arm connected with this member and having a guiding eye therein, and means for reciprocating said member, such means including a belt-driven shaft and belt-shifting means actuated by the movement of the reciprocating member.

Weaving of Pile Fabrics

(Reissue 15,184; August 30, 1921)

GEORG KOCH (assignor to Ernest Cadgene and Olav Berg, Paterson, N. J.)

The pile-weaving loom described in this patent includes, in combination, instrumentalities to support and advance the warp longitudinally in a given plane, a set of

impressionable filamentous weft-supporting bodies having free ends projecting in the direction of advance of the warp, every such body in the set being arranged in approximately the same plane substantially parallel with the first plane; means for forming a succession of sheds in the warp and also forming other sheds of some of the warp and said bodies, and means to pass filling through the first-named sheds at the side of said bodies corresponding to the first plane and arise through said other sheds at the opposite side of these bodies, the bodies having held against forward movement.

Process for the Manufacture of Diphenylamine

(1,392,942; October 11, 1921)

ARTHUR EARL HOULEHAN (assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.)

The process described for the condensation of aniline to diphenylamine comprises heating aniline to a temperature of from about 275 to 300 deg. Cent. in the presence of water with a small proportion of a halogen-containing substance as the active catalyst, which substance provides a source of a free halogen or the hydride thereof during the process.

Manufacture of Artificial Silk

(1,393,397; October 11, 1921)

EMILE BRONNERT

This describes a step in the process of making artificial silk which permits of predetermining the fineness of the thread to be produced, and comprises treating viscose in a coagulating bath containing a salt and an acid, the proportion of the latter to the whole being approximately inversely proportional to the square root of the thread size.

Manufacture of Viscose Silk

(1,393,198; October 11, 1921)

EMILE BRONNERT

This process of producing artificial silk threads consists in forcing viscose through suitable openings into a coagulating bath consisting of an acid, the concentration of which is proportional to the fineness of the thread desired.

Printing Attachment for Knitting Machines

(1,390,660; September 13, 1921)

GEORGE S. WEINERTH

The device described consists of a fabric-printing mechanism for circular knitting machines, comprising an attaching frame having operating-lever supports and a slide-way bracket with an extension forming a fabric-way, a reciprocative bed member in the slide-way, a pivoted inking device, means carried by the bed member operating to positively swing the inking device to operative and inoperative positions incident to the retracting and advancing movements respectively of the bed member, and lever mechanism for operating the reciprocative platen member.

AMERICAN DYESTUFF REPORTER

Monthly section devoted to the use and application of
dyestuffs and the mechanical equipment incidental thereto

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IN 2 SECTIONS
SECTION 2

This Section
includes the initial appearance
of the

Proceedings of the American Association
of Textile Chemists and Colorists

which will become a regular feature of
the Reporter from this time forward.

The matter covered in the present number
includes the minutes of the organization meet-
ing, the complete Constitution of the Associa-
tion, an account of the first meeting of the
Council, standing committees appointed, and a
list of charter members.

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Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

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Section 2

Waterproofing Cotton Duck

Description of the Various Methods of Waterproofing Cotton Fabrics, with Particular Reference to the Aluminum-Soap and Paraffining Processes for Treating Cotton Duck

By JOSEPH W. SAWYER

Calco Chemical Company, Bound Brook, N. J.

(All rights reserved.)

COTTON does not share the property of wool of absorbing water without conveying the wetness through to the material it covers. Therefore, cotton goods which are going to be subjected to weather conditions or the action of water should be treated to render them waterproof if they are to be used as a covering for objects which must be kept dry.

There are several methods in use for making cotton waterproof. Among them are: (1) Copper-ammonium; (2) cellulose acetate; (3) rubberizing; (4) drying oil; (5) aluminum soap; (6) paraffining. All of these methods have their advantages. As the writer's experience is confined chiefly to the latter two methods, this article will, in the main, discuss them.

The aluminum-soap method is used for material in which it is desirable to preserve the original feel and appearance. If properly treated the goods will be soft and pliable, and there will be no noticeable indication of the waterproofing. The paraffining method is used in cases where firmness, stiffness and weight are advantageous. Many people are incredulous about the waterproofing unless they can see and feel it; and, accordingly, they prefer the paraffine. Where goods are expected to stand extra hard usage, a combination of the two methods is often carried out.

Not all cloth can be made waterproof. Cheesecloth, for instance, can be made wetproof, but no treatment can be given it which will prevent water passing through. The material should be closely woven, without so-called pinholes or other defects.

The aluminum-soap method consists of passing the goods through a soap solution and then through a so-

lution of an aluminum salt, or by reversing the procedure. It is desirable to use a good quality of soap. Soap chips are to be preferred because of their greater solubility. There should also be a filler to cover over the interstices of the cloth, and this, of course, should be insoluble in water. Any compound soluble in boiling soap may be used. Among those in practical use are tallow, rosin, glue, gelatine, etc. The aluminum compound most often used is a mixed solution of acetate and sulphate.

For the best results the soap should be neutral. Alkaline soap is harmful because of the solvent action the alkali has on the filler after the waterproofing is finished. Unsaponified fat, on the other hand, might not be a detriment, since it would act as a filler itself. It is preferable, however, to use a high-grade soap, since the waterproofing bath is then more completely under control. The filler should be some compound which is itself waterproof and which is nonodorous. It should not impart a harsh feel to the cloth. Some compounds are in use which even improve the softness of the goods, but they are secrets of the trade and as such are jealously guarded. Rosin, while not the best, is a very effective filler and is commonly used; one objection to its use is that when the waterproofed goods are made up into wagon coverings, etc., the needles used in sewing pieces together become extremely hot and frequently break. However, rosin adds considerably to the waterproofing, does not seriously affect the feel, and, if of high grade, does not perceptibly discolor the cloth. It does not become rancid, like many of the fats sometimes used, and its odor is never unpleasant.

The aluminum-salt solution, or second bath, is generally made up in practice by mixing equal weights of sugar of lead and sulphate of aluminum in solution, diluting to the desired concentration and settling off the precipitated lead sulphate. Many operators, unacquainted with chemical reactions, believe that this final solution consists solely of the acetate, since equal quantities of the acetate and sulphate have been used, and they call it the acetate bath. A waterproofed condition may be obtained by the use of the sulphate alone, but experience has shown that the acetate gives evenner and more dependable results. The acetate is less stable, and decomposes when subjected to heat; the aluminum precipitates as a flocculent hydroxide, and the acetic acid set free distills off. This instability tends to make a more suitable form of aluminum soap. When sulphate alone is used there are apt to be spots in the cloth which are not adequately proofed. It is, however, advisable to have the sulphate incompletely converted to acetate for several reasons: (1) Lead acetate is much more expensive than sulphate of aluminum and the cost would consequently be greater; (2) the lead sulphate precipitated would be a nuisance, both at the time of mixing and afterwards, and there would be much time lost in waiting for it to settle so that it could be cleaned out of the settling tanks; (3) the sulphate is insurance against the spoiling of the bath by decomposition of the aluminum acetate through accidental overheating. When acetate alone is present, such overheating precipitates all the available aluminum. When both acetate and sulphate are present, the sulphate is not decomposed and remains in solution and carries on the work just the same, thus removing the necessity of stopping the machinery.

One advantage of the previously mentioned copper-ammonium method is that the cloth is rendered mildew-proof as well as waterproof. This advantage may be extended to the aluminum-soap method by adding bluestone to the acetate bath.

Waterproofing with aluminum soap is done with a padding machine similar to that used in slop padding in a cotton dyehouse, except that the dyeing tub must have a greater capacity. An average tank in operation contains 100 to 200 gallons of waterproofing mixture and the speed should be so arranged that each yard of the cloth takes ten seconds in passing through the bath. The goods move at a rate of twelve to fifteen yards a minute; it is not desirable to operate faster than this speed, because the filling material requires a little time to penetrate into the cloth. Rubber squeeze rolls are used, and they are set very tight. Run No. 1 consists of passing the cloth through the soap-filler solution, which is kept boiling, and drying to set the soap and filler. Run No. 2 consists of passing the cloth through the aluminum acetate bath at 112 to 115 deg. Fahr. and drying. The maximum temperature that can be used without danger of decomposition is 115 deg. Fahr. The baths are kept up in volume in each case by pipe lines

running in from side baths; the tanks are heated by closed steam coils.

The paraffining treatment is also carried out in a padding machine, but the squeeze rolls are generally made of steel and are heated internally by steam so that the paraffine is kept in a melted condition until it has been evenly spread over the cloth. The bath may consist simply of melted paraffine, but generally is a solution of paraffine in benzine. The weight and the stiffness of the goods are controlled by the concentration of the solution. Other materials which are soluble in paraffine or benzine may be added to improve the feel and appearance; among these are rosin, black wax, asphalt and various oils and greases. Insoluble pigments and loading materials are often used. The cloth may be excellently and permanently colored by the pigments if care is taken to constantly stir them while in the tank. The solvent is evaporated off in a well-ventilated air chamber and the cloth wound on rolls.

DYEING

Sometimes the cloth is dyed before the waterproofing; if this is done, in the case of the aluminum-soap method, the colors must be fast. Passing through a boiling concentrated soap solution is a severe test for any color. For this reason, and because it saves an extra run, the cloth is most frequently dyed at the same time that it is waterproofed. Dyeing after the waterproofing is not practicable; the waterproofed cloth does not take up the dye readily, and if the necessary measures are taken to force the dye onto the fabric the waterproofing is considerably damaged.

Three classes of dyestuffs are available for use in the dyeing: (1) Direct colors; (2) sulphur colors, and (3) vegetable colors. Vat colors are not used, because they are not easily handled at the boiling temperature. Sulphur colors give results as fast as ever required, but their disagreeable properties and difficulty of application prevent their general use. The bulk of the work is done, therefore, with direct and vegetable dyes.

The dyeing does not vary materially from ordinary slop-pad dyeing. There are some difficulties, however, not attached to regular pad work. To begin with, the material is generally heavy duck; not much of it runs under 6 ounces per yard, and most of it is considerably heavier, running up to No. 2 duck, which is about as stiff and as heavy as a board. Penetration of the dyestuff is out of the question, but it is necessary for the soap to penetrate if good results are to be expected with the waterproofing. Therefore a deep bath and slow motion through it are essential. Where in ordinary slop-pad dyeing the bath contains about 15 gallons, in waterproofing it contains seven to twelve times that volume; this means that it is so much the harder to keep the shade standard. The speed of the run is about twelve yards per minute, in comparison with fifty or more in the case of common pad dyeing.

It is extremely difficult to dry the heavy cloth; it must remain a long time in the dry house before rolling. With ordinary cotton the cloth is dry a few seconds after dyeing and the shade may be read immediately. With the heavy duck, fifteen minutes elapse before the fabric is dry enough to permit of reading the shade; during this time about 200 yards of material pass through the bath and the color may have changed somewhat from that of the swatch taken.

Straight colors are rarely dyed on waterproof goods; on account of the use to which the material is to be put, mode shades predominate, such as browns, olives, tans, drabs and allied shades. Almost without exception three different dyestuffs are required to obtain these shades, and the dyeing is an interesting and puzzling proposition. No three dyestuffs are ever found which exhaust alike, and it requires considerable experience and skillful handling to hold a semblance of the same shade through a day's run of ten hours. After a dyer has used the same colors over a period of time he can roughly estimate the proportional exhaustion. He is then able to adjust his side bath so that it feeds in the proper amount of each color to replace that stolen by the cloth. For instance, if the original bath contains 1 part red, 1 part black and 3 parts yellow; the side bath may have to be built up with 1.4 parts red, 2 parts black and 3 parts yellow.

The soap and chemicals in the waterproofing bath often affect the dyes and cause them to change during the dyeing, but this does not occur so frequently with the direct as with the vegetable dyes. No salt is added to force the color on, as it is desirable to use as few chemicals as possible in the bath. The bath acts in a peculiar manner; 10 yards of 36-inch No. 10 duck absorb and carry away with them 1 gallon of liquor. That gallon contains considerably more than its proportion of direct color, practically its proportion of soap, and much less of filler. These differences are, of course, equalized in the side bath, whose function it is to be constantly replacing the material carried out of the main tank. If it does not thus function the main bath constantly changes in color and grows thicker and thicker as the run continues.

Other difficulties which beset the waterproof dyer are the volume and the cost of his waterproofing bath: 125 gallons of dye liquor are not so easily to be kept in control as are 15, and they are not so lightly to be thrown away. An ordinary pad tank holds only a few ounces of dyestuff and salt, and it is not extravagant to run this down the sewer at the close of the day's operations; but the waterproofing tub contains over 100 gallons of a concentrated soap solution holding with it the dissolved filler, which is usually a rather expensive material. Therefore it is a common practice to save the liquor for another run of the same shade, which may take place a week or even a month hence. As a general rule, direct colors do not vary much in shade on standing in water solution, but when mixed with soap, etc., a change in color takes place and it is then

the dyer's duty to bring the shade back by proper addition of more dyestuff.

The whole story may be narrowed down to this: The dyer must know his colors, and he must have his side bath properly proportioned. If the cloth gets off shade a little, as it is bound to do sometimes, it is a better practice to doctor up the main bath than to tamper too much with the side bath. If too much of a color is added to the latter it will prove a curse to the end of the run, while the main bath can be brought up or down without affecting more than two or three pieces of cloth. Sometimes it is necessary to redye the goods. In that case it should be done before the second waterproofing treatment. The dyeing bath should contain from a third to a half as much soap and filler as before. Some is necessary, or the boiling dye liquor would wash off the soap already on. Too much is to be avoided, both as a matter of expense and because the results are not as good.

The colors change somewhat during the second or aluminum-acetate run, but seldom seriously; after a little experience with the colors the amount of change may be forecasted and prepared for. The shades are often brightened in the acetate bath with basic colors: these colors go on readily at the temperature of the acetate bath, the direct color already on, or the aluminum soap, seeming to act as a mordant.

Considerable dyeing is done with vegetable dyes, such as logwood, cutch, gambier, fustic, bark, etc. These give all the shades required of waterproofed cloth. They are fully as bright and are faster than the direct colors, and are dyed the same way except that they must be developed before the shade is brought out. Development is secured by using either sodium or potassium bichromate in the second or acetate bath. This increases the difficulty of the dyeing very much as oftentimes it is advisable to run the first treatment three or four days at a time before starting on the second. Accordingly, the dyer has thousands of yards of cloth on his hands without any dependable check on his shade. In the case of aniline dyes his troubles are all over at the end of the first run, but with vegetable colors they are just beginning. The concentration of the chrome in the acetate bath and the temperature have as much to do with the final shade as the percentage of dyestuff in the original formula. The stronger the chrome solution and the higher the temperature the browner the shades.

Vegetable colors in solution are more sensitive to soap and to oxidation on standing. They are more apt to change in a day's run; and since when the first run is completed there is no indication on the cloth of the final shade, it is a hard proposition to doctor up the bath. Cuts may be taken from a piece on emerging from the dry house and developed. They will be a help, but they do not accurately represent the final color. Vegetable colors seems to penetrate a little better than the synthetic dyes, and are preferred by many dyers.

The waterproofer-dyer has somewhat the same problem as the woolen dyer, in that the cloth he works with is expensive and any spoiled material represents a serious loss. The ordinary cotton dyer deals with such cheap stock that he can afford to discard a small percentage of it; but not so with the man who operates with ducks which run up to a dollar or more a yard. At first glance it seems strange that such expensive fabrics should be treated with fugitive dyes. This, however, is allowable on account of the uses to which the goods are to be put. The lack of fastness to washing may be ignored, because waterproofed material never is washed and rain water never gets through to the color. The stuff is made up primarily for service rather than appearance. It is not important, for instance, that the color on a wagon cover fades when the same wagon cover is subjected to all forms of dust and dirt, etc. It is nice to have a pretty shade dyed on a sportsman's coat, and he buys the coat which looks best to him; but six months later the color is not so important after he has worn the coat through swamps and woods, etc., and has it plentifully stained with pitch, powder and other markings of which he is by no means ashamed. An awning is not only exposed to sunlight but also to all kinds of street dirt, and even if the colors are fast they do not look well after a few days. Therefore, permanency of color is not the prime requisite that it is with flag cloth or hats or overcoats or shirtings.

For paraffining, the cloth is always dyed previous to the operation unless the coloring is done by means of pigments stirred into the waterproofing dope. The dyeing may be done by any method, but most frequently by padding, as that is the cheapest. As one run must be made anyway for dyeing, it is oftentimes considered profitable to give the cloth the aluminum-soap treatment beforehand. The expense is then only increased by the cost of one run and of the chemicals, and the waterproofing is much more permanent. In this case mineral fillers such as lead sulphate, a cheap by-product, may be worked in in the acetate bath and held in place by the paraffine coverings. This increases the weight considerably, a great advantage for the rough work for which some cloth is intended. Paraffining increases the strength of a color considerably and a shade cannot be considered matched until the whole process is carried out.

Drying is a serious problem in a waterproofing works. Heavy goods such as are commonly treated carry out of the bath a tremendous amount of water. For instance, 10 yards of 48-inch No. 4 goods carry out 2 gallons of liquor. To evaporate the water without holding up the run requires considerable heat, heating space and good ventilation. Drying cans, tenter frames running back and forth over rolls in a dry house, and combinations of these methods have been used, but on damp and rainy days no method appears to dry the goods properly. A combination of drying cans and hot-air chamber seems to work best. This

difficulty in drying would limit the cloth to the slow speed used in waterproofing, even if it were not best for other reasons. Twelve to fifteen yards a minute seems to be as fast as the heavy goods can be run and the proper drying secured. Allowing some time to get started in the morning, 6,000 yards per machine for one run is a good day's work.

A waterproofer is sometimes called upon to treat goods which have been made up into tents, tarpaulins, etc. As made-up fabrics are not readily to be padded, they are generally waterproofed by the spreading on of a dope. A common dope consists of paraffine, rosin, tar, etc., dissolved in benzine. The results are not so good and are only an expedient; they seem to serve the purpose, however. Waterproofing mixtures are on the market in 1 and 2 pound cans, etc., which are generally paraffine mixtures and which may be applied at home. There is no real substitute, however, for buying cloth already waterproofed.

Linseed-oil mixtures are used in waterproofing, not only on a small scale but also with commercial work. The cloth in this case is run in contact with brushes, which paint on the oil mix after the manner of coating paper. Only one side of the cloth is waterproofed. Airplane cloths are frequently treated by this brushing method; in this case the dope is a solution of cellulose acetate in acetone, or some other organic solvent. Raincoat cloth is spread with a dope of which the main constituent is rubber mixed with cementing materials.

Various tests have been suggested for determining the efficiency of the waterproofing. The Government, for instance, specifies that sections taken from the fabric must support a column of water so many inches high a specified length of time. The writer is more in favor of the tests which keep in mind the eventual use of the cloth. One good way is to tie pieces of the cloth about 9 inches square into bags, filling the bags full of water and hanging the bags up. No drops of water should pass through the cloth in twenty-four hours. Another good method is to suspend the cloth under a slowly running stream of water in an angular position with the stream. The water should run down the cloth for several hours without penetrating it. Paraffined cloth, contrary to general opinion, does not stand up under these two treatments as well as the aluminum soap treated. Once in a while a strip of paraffined cloth shows up in which there is a leak through a pinhole, whereas no leak is to be found in goods waterproofed by the soap method for weeks at a time. The real fault is not with the paraffining, but with the cloth. The aluminum soap covers up pinholes better than the paraffine. In cloth given the combination treatment, leaks are almost unknown.

Following are a few of the products made from waterproofed fabric: Awnings, tarpaulins, wagon covers, sails, tents, sportsmen's clothes and utensils, raincoats, knapsacks, automobile covers, canvas gloves, water bags for tourists, covers for harbor lighters.

(Continued on page 41.)

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The American Association of Textile Chemists and Colorists

President

LOUIS A. OLNEY
Lowell Textile School, Lowell, Mass.

Vice-Presidents

WILLIAM D. LIVERMORE WILLIAM H. CADY

Secretary

WALTER E. HADLEY
5 Mountain Avenue, Maplewood, N. J.

Treasurer

WINTHROP C. DURFEE
516 Atlantic Avenue, Boston, Mass

Councillors

JAMES L. AMSDEN	GEORGE A. MORAN
ELMER C. BERTOLET	WILLIAM K. ROBBINS
ARTHUR E. HIRST	WALTER M. SCOTT

PROCEEDINGS OF THE INAUGURAL MEETING

Held at the Engineers' Club, Boston, Mass., November 3, 1921

THE meeting was called to order at 3 p. m. by Louis A. Olney Chairman of the Organization Committee. After brief remarks, in which he expressed the gratification of the committee over the enthusiastic response with which all of their endeavors had been met, and coming upon the fact that probably at no previous time had so many American textile chemists and colorists gathered together upon a seriously-minded purpose, he proceeded to outline the business of the meeting.

In explaining the purpose of the meeting the Chairman said:

"We have come together this afternoon to continue and complete the work of organizing the American Association of Textile Chemists and Colorists. Preliminary steps were taken in New York early in September, and those of you who were present will remember that at that time the Chairman was authorized to appoint a committee of five or more and such subcommittees as might be deemed necessary to make further preparations and present definite plans for completing the organization at a meeting to be held during the week of the Textile Exposition in Boston.

"Such committees were duly appointed and have been diligently engaged, and you have been called together at this time to consider the definite plans which they are ready to present."

The personnel of the committees appointed by the Chairman was as follows:

GENERAL ORGANIZATION COMMITTEE

PROF. LOUIS A. OLNEY, Chairman;
Lowell Textile School,
Lowell, Mass.

WALTER E. HADLEY, Secretary;
Chief Chemist, Clark Thread Co.,
Newark, N. J.

WILLIAM D. LIVERMORE,
Chief Chemist, American Woolen Co.,
Lawrence, Mass.

GEORGE A. MORAN,
Chief Chemist, Pacific Mills,
Lawrence, Mass.

WALTER M. SCOTT,
Chief Chemist, Cheney Bros.,
South Manchester, Conn.

WILLIAM R. MOORHOUSE,
National Aniline & Chemical Co.,
Boston, Mass.

ROBERT E. ROSE,
Director of Application Laboratory, E. I. du
Pont de Nemours & Co.,
Wilmington, Del.

WILLIAM H. CADY,
Chief Chemist, U. S. Finishing Co.,
Providence, R. I.

FREDERIC DANNERETH,
Textile Trade Laboratory,
Newark, N. J.

A. E. HIRST,
Chief Chemist and Assistant Superintendent,
American Printing Co.,
Fall River, Mass.

SPECIAL COMMITTEES

Committee on Inaugural Meeting, Program and Nominations

WINTHROP C. DURFEE, Chairman;
Consulting and Manufacturing Chemist,
Boston, Mass.

WILLIAM R. MOORHOUSE.

RUSSELL W. HOOK,
Textile Chemist, A. D. Little & Co., Inc.,
Cambridge, Mass.

WALTER S. WILLIAMS,
Chemical Engineer, Mount Hope Finishing Co.,
North Dighton, Mass.

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HARRY R. DAVIES,
I. Levinstein & Co.,
Boston, Mass.

Committee on Constitution and By-laws

WILLIAM D. LIVERMORE, Chairman.

GEORGE A. MORAN.

WARREN H. WHITEHILL,
Chief Chemist, Brightwood Manufacturing Co.,
North Andover, Mass.

JOHN F. BANNAN,
Chief Chemist, M. T. Stevens & Sons Co.,
North Andover, Mass.

HUGH CHRISTISON,
Chief Chemist, Arlington Mills,
Lawrence, Mass.
tile Schools,

Committee on Membership

HAROLD W. LEITCH, Chairman;
Chemical Engineer, M. T. Stevens & Sons Co.,
Franklin, N. H.

ELMER C. BERTOLET,
Professor Textile Chemistry, Philadelphia Textile School,
Philadelphia, Pa.

FREDERIC DANNERETH.

Committee on Publicity and Publications

E. H. KILLHEFFER, Chairman;
Newport Chemical Works,
Passaic, N. J.

WALTER E. HADLEY.

FRANK C. HOLDEN,
Chemist and Dyer, Chelsea Fiber Mills,
Brooklyn, N. Y.

Continuing, the Chairman said:

"I wish to express my appreciation of the most hearty and willing support received from all of these committees. They have been extremely industrious, having kept diligently at their tasks until their particular part of the work was completed.

"We will now proceed with the business. Mr. Durfee has suggested that to make this meeting more official we should organize in some way. Notices of this meeting were sent out in the form of invitations to become Charter Members. After the General Committee had considered the various methods by which this meeting might be called, they decided upon the charter membership plan, as it had worked satisfactorily with other organizations and in our particular case appeared to be the best procedure to follow. As a result, the Committee carefully selected a number of representative men whom they believed to be qualified for active membership in such an association as they had in mind. This list by no means included all who might be eligible and desirable, but con-

stituted a thoroughly representative group. About two hundred and twenty-five have already returned blanks indicating their desire to become Charter Members, and of that number approximately one hundred and forty are here to-day. If anyone wishes to make a motion to the effect that the men who have signed the charter membership blanks be constituted as members of this association with power to organize and transact business, I shall be pleased to entertain such a motion."

Mr. Durfee—"I move that those present, and those who have already signed the applications to be Charter Members of such an association, hereby organize themselves into the American Association of Textile Chemists and Colorists."

Motion was seconded by Mr. Hirst and carried.

At this point the Chairman announced that a telegram had been received from Walter E. Hadley, Temporary Secretary of the Organization Committee, stating that he was confined to his home by a severe cold and expressing his regrets at being unable to attend. The Chairman stated that instead of appointing another secretary, a stenographer had been engaged to take notes which would later be turned over to the Secretary.

The first report presented was that of William D. Livermore, Chairman of the Committee on Constitution and By-laws.

Mr. Livermore—"Mr. Chairman and gentlemen, the Committee on Constitution and By-laws has drafted a tentative constitution, based on the plans of the various engineering and chemical societies, and applied to what the committee imagined were our needs. Is it your wish, Mr. Chairman, that we read this?"

Chairman—"I think perhaps the best way will be to consider the various articles of this constitution and accept them separately, and when they have all been accepted, finally adopt the constitution as a whole."

Mr. Livermore then read Articles I and II of the proposed constitution, referring to name and object of the Association. These were accepted as read. (Note.)

Chairman—"This is one of the important Articles of the constitution. I would like to say a few words in regard to it, if I may be permitted to do so. Our Committee on Constitution and By-laws had it in mind to uphold the standing of this Association in such a way that an Active Membership would really stand for something in the field of textile chemistry and the application of dyes. It is their belief that the rules expressed therein should be carefully enforced. They were, I understand, patterned somewhat after the membership rules of the American Institute of Chemical Engineers. Of course, this Article does not apply to Charter Members. The invitations had to be sent out before the constitution could be accepted. We had to organize in some way, and this seemed to be the way of doing it. From now

[Note—The entire Constitution, as finally adopted, is printed immediately following the minutes of this meeting.]

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on, I presume, it is the intention of the members who drew this constitution to recommend the strict enforcement of these rules."

Mr. Livermore—"Our committee sees no present occasion for associate memberships, and would recommend that Sustaining Membership should be laid over for future consideration when the Association may have something definite to offer."

Chairman—"I agree with that. I believe we should not make an attempt to interest outsiders until we have something definite to present, but I sincerely hope that the developments of the next few months will make it possible to present something tangible to the textile manufacturers, and others, so that they may become sufficiently interested in this Association to support the work which it may undertake. I might add that Article XI of the constitution, which will be presented later by Mr. Livermore, has a direct bearing upon this matter."

Article III was then accepted as read.

Articles IV and V, referring still further to membership, were then presented and passed as read.

Chairman—"Now, gentlemen, we do not want the whole constitution passed without any expression of opinion. If there is any portion in regard to which you do not approve, we want you to say so. Remember, this should be your constitution and not necessarily the committee's."

Article VI, referring to annual dues, was then read.

Mr. Livermore—"I will say in connection with this Article that we had to decide upon some figure, and as at the beginning of the life of the Association we should not publish a journal, the figure set was intended to be one that would not include the cost of anything of that sort. Later, if a journal were published separately, naturally the dues would have to be arranged to cover that."

Chairman—"As Mr. Livermore has said, the Committee endeavored to keep the dues as low as they could in proportion to the work that would be undertaken at the beginning, but thought it well to have the modification that the Council could raise the amount of dues without referring the matter to the society as a whole in case they find it necessary."

James L. Amsden—"I would like to inquire if, in the opinion of the membership, it might not be advisable to have our fiscal year start at some other time than the first of January. About every organization one belongs to begins its year on the first of January, and often accumulated dues make a very considerable sum to be handed out at one time. It seems to me an organization of this sort may just as well start the fiscal year at some other day, some other month. I offer that as a suggestion."

Chairman—"Do you suggest any particular time?"

Mr. Amsden—"I have not thought of any particular time, but, as we are organizing now, it might be well to make it the first of November."

Chairman—"Do you offer that as a motion to amend this Article?"

Mr. Amsden—"In order to bring action on it I will, Mr. Chairman, offer an amendment to the Article, that the fiscal year begin November 1 instead of January 1."

Mr. Livermore—"In that case you would modify the date after which no dues were required for a member newly elected; perhaps move it back two months?"

Mr. Amsden—"I should say it would be well to incorporate that in the idea."

The motion was seconded by N. A. Schaeffer and passed.

Article VII, referring to delinquencies and resignations of members, was next read by Mr. Livermore and accepted without discussion.

Article VIII, providing for Officers and Council, and method of election, was then read and accepted without discussion.

Chairman—"Gentlemen, you must remember that after we accept this constitution it will stay in force for some time, we hope, and it will be easier to change it at the present time, if you think it is necessary, than afterwards. Please keep that in mind as we proceed with these various Articles."

Articles IX and X, referring to the duties of the Council and the method of appointing committees, were then read by Mr. Livermore.

Chairman—"You have heard this Article. This, in a way, is very important, because much of the work of the Association will necessarily have to be done through these committees. It will probably be impossible for the majority of the members to come together more than once a year. It is possible, however, for committees, if they are selected geographically, to meet quite often and transact some of these important matters. These various committees, I believe, at the present time cover the requirements very well. There may be some committees, however, that are important, that have been overlooked; so if there are any suggestions in any way as to these committees we should be pleased to hear them. I will read them again: Finance Committee, Committee on Membership, Committee on Meetings, Committee on Publication, Library Committee and Committee on Research."

Article XI, authorizing the Council to arrange on such terms as it found desirable for co-operation with the textile or color industries and societies or corporations for the purpose of carrying out such investigations or such form of standardization of products or methods as might be mutually regarded as valuable to the progress of these industries, was next read by Mr. Livermore. This Article was then accepted without discussion.

Article XII, referring to method of amending the constitution, was then read by Mr. Livermore and accepted without discussion.

The remainder of the document, including Articles XIII-XVII inclusive, referring entirely to local Sections, the method of their formation, geographical designation, officers, financial responsibility of the parent Association, reason for, and the methods of the dissolution of such

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Sections, was then read by Mr. Livermore in its proposed form.

Winthrop C. Durfee—"On the question of procedure, whether there is any veto power left in the Association or the Council itself: suppose, for instance, they should want to form a Section in Brooklyn and another in New York City, and the Council of the Association should not deem it wise to have two Sections in that locality; this enables twenty-five men to say there shall be two Sections in that place, and that is the end of it."

Mr. Livermore—"It enables twenty-five men in each place to call a meeting, and the meeting shall decide whether there shall be a Section or not."

Mr. Durfee—"What meeting do they call—of the Association, or of themselves?"

Mr. Livermore—"Probably they will call a meeting of the section in which it is formed."

Mr. Durfee—"I am trying to find out whether there is any power in the Association to veto or approve these Sections."

Chairman—"Apparently not."

Mr. Durfee—"Apparently not."

Chairman—"Mr. Durfee seems to believe there should be the power of veto on the part of the Council."

William H. Cady—"Does not that power exist in the Secretary to call the meeting? It seems to me it does."

Mr. Livermore—"The Secretary is really obliged to call the meeting if twenty-five members notify the Council of their desire to form a Section."

Mr. Cady—"The Section is not in power unless it is approved by the Council. Is not that the way it works out?"

Mr. Livermore—"I think that is a fair matter for discussion in this connection: whether or not we shall have local autonomy completely, or whether we shall have the Association, as a whole, decide whether or not a Section may be formed. I went through, myself, the existence of the local Section in this district of the Society of Chemical Industry, and we did not think we had very much self-determination, and we would have liked it different in some respects.

"Now, perhaps we have gone too far the other way and left it too absolutely in the hands of the members in any particular section to decide whether they will have such a separate Section or not. It may be that if there were a section in New York and another in Brooklyn, and twenty-five persons in Brooklyn decided to set up a separate Section, it would be an undesirable thing.

"I think it will be a very desirable subject for discussion as to whether or not there shall be embodied in this constitution any right on the part of the Council to veto a proposal by the unanimous vote—or by a two-thirds vote—to veto a proposal for a new Section."

Mr. Durfee—"Mr. Livermore, I will change that suggestion to, 'that on the application of such twenty-five members to form a local Section, and upon the approval of the Council, a secretary shall be appointed.' I think that covers the whole ground, Mr. Chairman."

Mr. Livermore—"I think that is a very good amendment, and I would like to have a vote on it."

Walter S. Williams—"I second it."

Chairman—"Motion is made by Mr. Durfee and seconded by Mr. Williams that Article XIII, relating to Sections, be changed so as to read, 'twenty-five or more members residing in any district may notify the Council of their desire to form a local Section, and upon approval by the Council a secretary *pro tem* shall be appointed by the Council, who shall call a meeting of the members in that district.'"

Mr. Livermore—"Why not say: The Council shall vote upon the desirability of the formation of such a Section, rather than upon the formation of such a Section? You do not need to form a Section then. The Section is not formed until afterwards."

Chairman—"If approved: 'twenty-five or more members residing in any district may notify the Council of their desire to form a local Section. Upon the approval of the Council a secretary *pro tem* shall be appointed to call a meeting of the members of that district. This meeting shall decide as to whether a local Section shall be formed.'"

Robert E. Rose—"Mr. Chairman, I would like to ask Mr. Durfee whether he provides for a majority vote, or two-thirds vote; or what is approved."

Mr. Durfee—"I do not think it will be necessary to put that in. The Council controls its own deliberations and comes to its own decision."

Mr. Livermore—"That amounts to a majority vote."

Mr. Durfee—"I do not think we would go as far as that at present."

Chairman—"You have heard the motion, gentlemen. All in favor of accepting this revised amendment raise their right hands, please. All opposed? Seems to be unanimous. Are there any further recommendations in regard to this Article?"

Mr. Cady—"Mr. Chairman, is there any chance of a misunderstanding as to the size of a district? There is nothing in the Article as to what constitutes a district, geographically."

Chairman—"No, there is not."

Mr. Cady—"Supposing a group of men in Brooklyn wanted to start a Section; would that include New York also?"

Mr. Livermore—"That would depend a good deal on the members in New York."

Chairman—"Of course, there is the question of how advisable it will be to attempt two Sections too near together. It would be far better to have one Section that was strong than to have two Sections within a comparatively short distance of each other; twenty-five miles or less. Of course, the Brooklyn-New York illustration is a little exaggerated; but it may not be, at that."

Walter M. Scott—"I think that provision has been amply covered by this last amendment. That is: it is really up to the Council to decide whether the district should be organized as a Section or not."

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Chairman—"Yes, exactly. It simple leaves it to the judgment of the Council, and I think any further changes simply resolve themselves into whether or not we doubt the wisdom of the Council in acting in any such case as this."

Mr. Livermore—"I do not know that this is worth mentioning, but I think it was the idea of the Committee, and of others with whom the matter has been talked, that there would be, early in our history, only a few Sections in obviously desirable places such as Boston, New York, Philadelphia or districts thereabouts. If it later developed there was a demand for Sections in other districts, provision is made for that."

Amos K. Hobby—"Mr. Chairman, it seems to me it would be necessary to have geographical limits; therefore, I suggest that the Council, at the time of approving a Section, limit it geographically."

Chairman—"A point also arises which is not clear in my mind. If there are twenty-five men over in Chelsea who wish to form a Section, and there are fifty men living in that district, are the other twenty-five men automatically put in that Section rather than the Boston Section, whereas they might wish to remain in the latter?"

Mr. Livermore—"They are, automatically, by the meeting when this Section is formed. They are invited to that meeting, and, of course, if there were twenty-five members in Chelsea who wanted to form that Section, and fifty more who did not want to form that Section, all seventy-five would be invited to that meeting, and it would be up to the fifty who did not want it to vote down those who did."

Chairman—"This matter is still open for discussion."

Hugh Christison—"I do not know whether there is any need for geographical limitation, for this reason: we have a number of men who are very much interested in this Association, in Lowell and Lawrence. It is a foregone conclusion that we are going to have a Boston Section. With a Lowell or Lawrence section, some men near these places might be forgotten, and I think a member should be at liberty to choose for himself whether he wants to associate himself with a Boston Section, or a Lowell or Lawrence Section. It will disrupt the society, I think, if he is coerced or compelled to belong to one Section because of his residence. There are people to whom, because of their business connections, a Boston Section would be more acceptable, and they might prefer Boston and would not care to belong to a Lawrence or a Lowell Section, or vice versa."

Mr. Hobby—"Mr. Chairman, I think you have either got to revert to the original Article which definitely says a Section is so organized, or else you have got to limit the existence of a Section, one way or the other."

Mr. Livermore—"Well, would it meet your view if it read, perhaps, 'engaged in business or professional pursuits in the territory of the local Section and shall be regarded as belonging to that Section unless they signify in writing to the Secretary of the Association some other preference.'?"

Mr. Durfee—"That is right."

Mr. Livermore—"Or do you wish, in other words, to leave every member an option as to what Section he should belong to, or whether he should belong solely to the Association rather than to a particular Section?"

Mr. Hobby—"I am personally in favor of having an option as to with which Section he shall associate himself, but I do not think that can be worked out, and until that situation arises I think it will be preferable to limit the Section geographically. I will make a motion that the Council limit geographically the territory to which a Section shall apply."

Chairman—"That does not help Mr. Christison. There are two points confused, in a way. Shall we limit, geographically, and then oblige every man in that district to be a member of that Section, or shall we give an option in a particular district so that a member might belong to one or the other?"

Mr. Durfee—"Mr. Chairman, I think Mr. Livermore's suggestion covers both points, that the Council shall limit the local Section geographically, and any member in that territory shall be a member of that Section unless and until he notifies the Secretary he wishes to belong to some other. That is your suggestion?"

Mr. Livermore—"Perfect!"

Mr. Durfee—"I think that covers it perfectly. I make the motion."

Mr. Christison—"I second it."

Chairman—"The motion is made and seconded that this amendment be accepted. Now, I would suggest that during the dinner hour these amended Articles be redrafted and presented to the meeting afterwards, for acceptance in final form. Just this Article; that is all."

William K. Robbins—"Might it not be well to consider, in this connection, that as a local Section is expected to incur some expenditures of the money of the whole Association, that either the by-laws of the local Section ought to be such as not to conflict with the By-laws or arrangements of the Association; or would they do so as provided by the Council, to make sure the tail does not eventually wag the dog? I propose that."

Chairman—"Will you state that once more?"

Mr. Robbins—"That some provision should be made for approval by the Council of the by-laws or method of organizing a local Section, so that they shall not conflict with the By-laws of the parent Association."

Chairman—"I think that is perfectly clear. Is that seconded?"

Mr. Livermore—"I second the motion."

Chairman—"All those in favor of amending the Article as suggested, say 'Aye.' Contrary minded? It is a vote. Are there any other points about this particular Article?"

Leroy C. Lewis—"Will the \$5.00 dues of the Association cover local dues?"

Chairman—"As stated in the constitution, it will. We have no local Sections, of course, to start with. Probably they would not be organized for some time; that is,

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a few months at any rate; and another year, according to the constitution, the Council have it within their power to raise the dues, which would take care of that, if necessary."

Mr. Livermore—"In the matter as it now stands the idea was that local Sections should be able to spend an amount equal to a dollar for every member at the expense of their original dues. That is to say, they would get that money back from the Treasurer of the Association, but if they want to spend any more money than that it is up to them."

Chairman—"Any further discussion of this particular matter?"

Walter C. Durfee—"Mr. Chairman, we provide for the birth of this Section, but we have not provided for its death in case it loses twenty-five members."

Chairman—"Well, what do you say about that, Mr. Livermore?"

Mr. Livermore—"We are not engaged in funerals yet."

Chairman—"Do you wish to suggest something, Mr. Durfee, to provide for the funeral?"

Mr. Durfee—"I should like to provide for its life by saying it should retain its membership; something of that sort."

Mr. Livermore—"Well, you can very easily add a provision in that Article that any Section may, at any time, dissolve by the vote of its members."

Mr. Hobby—"Mr. Chairman, I suggest that there should be one more duty on the part of the central Council: that by vote of the Council, any local Section may be dissolved; that is, if the local Section is not thriving, it might be obliterated."

Chairman—"Would you put it as strong as this: That at the discretion of the Council a local Section can be disbanded?"

Mr. Livermore—"Rather strong."

Chairman—"Rather strong; yes. Will you make that as a motion, Mr. Hobby, in order that we can get an expression of opinion?"

Mr. Hobby—"Yes, sir. I would like to see the question raised whether or not it would be wise to arrange it so the members may dissolve themselves. I will simply make the motion, if seconded, that the Council has the authority of discontinuing any Section that is not efficient."

Mr. Durfee—"In its discretion?"

Mr. Hobby—"In its discretion."

Chairman—"The motion is made that the Council have the authority to dissolve any Section, at their discretion. Now, in order that we may get a vote, I think I would like to have someone to second it."

Mr. Livermore—"I believe I would be willing to second that; only I think we should add to it a little bit, in the event that this Section should have fallen below the original twenty-five prescribed members. That is, I would not say we should leave it to the Council, or give the Council, authority to disband it if it still had twenty

members, say, or forty members; but if it fell below its original twenty-five membership, I should say then the Council has authority to disband it at its discretion."

Mr. Hobby—"I think that is all right."

Charles S. Hollander—"May I say that even if the membership of the Section is twenty-four or twenty-three, it may be a very strong Section at that; it may have more life than a Section that had one hundred members. It would be an injustice, then, to discontinue such a Section just on account of the numbers."

Mr. Livermore—"If it were a live Section, the Council would use their discretion not to dissolve it."

Dr. Hollander—"Then we only want to insert 'that on the discretion of the council'?"

A Voice—"Mr. Chairman, I simply want to suggest that the Council cannot disband a Section if the Section was above twenty-five members, but there is nothing said about the Council having to disband it even though it is down to fifteen members, providing they are active, if they just have the authority to do that, at their discretion."

Mr. Livermore—"Do you not think, as the matter stands, that would make a Section continue to live automatically, even if it wanted to dissolve itself? If you say that the Council cannot dissolve a Section containing more than twenty-five members, suppose the Section does want to dissolve but it still normally contains twenty-five members. How could it be dissolved, then?"

Same Voice—"Mr. Chairman, my original idea was only to prevent the Council from dissolving the Section if that Section contained more than the original required membership; that is, its original twenty-five members. There is nothing to prevent its dissolving that Section if the Section has fallen below that point."

Mr. Hobby—"Mr. Chairman, I think perhaps we'd better include another provision that the Council shall dissolve the Section at the request of the Section, voted upon by a majority of the members."

Chairman—"It would be a very simple matter to add a clause to the effect that any Section can disband on vote of the majority of its members. It is a very simple matter to do that. That can be made as an addition, anyway."

Mr. Livermore—"Yes, I wanted something like that brought in."

Wallace J. Murray—"It seems as though the previous provision we made ought to take care of that; if the members decide they do not want that Section maintained, they would amalgamate with the neighboring Section. If eighty want to amalgamate the Section, that would have to be automatically removed. If we saw people going away we would know they desired to dissolve. I believe this clause covers that entirely."

Mr. Livermore—"I think that was provided for if the Section falls below twenty-five members, or if twenty-four members it might dissolve by a vote of the council; and then, if you also provide that any Section may dis-

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solve by a majority vote of its own members, you have covered both cases."

Chairman—"Then, let me be sure we understand about this amendment: That in case the membership of a Section falls below twenty-five, the Council may, in their discretion, dissolve that Section, if they deem it in the interest of the Association. And then, in addition to that, a whole clause saying that any Section may dissolve upon a three-quarters vote of that Section."

Mr. Livermore—"I do not think you could ever get three-quarters vote on anything in a dying Section."

Chairman—"Majority vote; how is that?"

Mr. Livermore—"Yes."

Chairman—"Now, those are the two amendments, gentlemen, we are going to vote on; they have been made by Mr. Hobby and seconded by Mr. Cady."

(The motion was thereupon put to a vote and carried.)

Chairman—"Now, with the exception of the clause that is to be revised and presented later, I think we can vote on the acceptance."

A Voice—"Mr. Chairman, is there any provision made for the transfer of a member from one Section to another? For instance: a man is in New York and he comes to New England to work. Does he automatically become a member of the Boston Section?"

Mr. Livermore—"I do not think we are obliged to transfer him unless he notifies the Secretary. In the provisions we are putting in here, we say that members engaged in business or professional pursuits in the district of the local Section shall be regarded as belonging to that Section, unless the member notifies the Secretary in writing of his desire to become a member of another Section. I think it will cover it every way."

Chairman—"I think so. Are we ready to vote on the constitution as a whole?"

Mr. Amsden—"There are a number of doubtful phrases in the instrument as it has been presented, and one of those you are going to revise during the dinner hour. Some of the others, perhaps, you will put in a little more precise language. Would it not be well, unless it is going to interfere with your further activities at this time, to postpone the voting on this entire constitution until after the dinner hour, when it can be presented to us in its full form just as it is intended to be adopted?"

Chairman—"I think that is a good suggestion."

Mr. Livermore—"I think so. I do not see how it can be voted on any other way."

Chairman—"Unless you have some other suggestion, we will leave the matter with the Committee."

Mr. Livermore—"I think it would be well, before we do that, to inquire whether there is any fundamental suggestion to be made other than has appeared. If we reform our phraseology in several things and change our dates to conform with the amendment as adopted at this gentleman's suggestion, we would then like to have the thing accepted in its fundamental character. If there are any changes to be made, I think they should be proposed

now and let the matter of presenting the final article only remain until after the dinner hour."

Chairman—"I think that is a very good suggestion, Mr. Livermore, and with that in view I would like to ask once more if there is any part of the constitution, as read, that is open to further criticism or suggestion."

Mr. Durfee—"Mr. Chairman."

Chairman—"Mr. Durfee."

Mr. Durfee—"We have six committees here, and the Council. The definition of the functions or duties of those committees must be determined either by the Council or else by the committees themselves. I think we should make that definite. They will not work unless they are definitely assigned."

Chairman—"Article X you refer to; it reads: 'The Council may appoint committees to have charge of special affairs as follows. Such committees may be made up from the Council or from the general membership, or both.' What you suggest is that there shall be some responsibility placed either on the Council or the committees?"

Mr. Durfee—"Yes; the word 'functions' should be determined either by the Council or by the committee."

Mr. Livermore—"Very easy to have a phrase saying that the duties of such committees shall be defined by the Council at the time of appointment, or shall be defined by the Council."

Chairman—"Will you make a note of that, Mr. Livermore?"

Dr. Hollander—"Mr. Chairman, is not that a fairly easy matter in regard to the Committee on Finance, or Meetings, or any of those? But the Committee on Research; they would want to be self-determining, I think."

Mr. Livermore—"They would be self-determining as to what they would do, but the character of the work submitted to them—that is, their field—would be defined by the Council. That is to say, the Committee on Research could easily be limited from conflicting with the Committee on Publication, by the Council. Further than that it would not be necessary at all, as far as our Council would go."

Chairman—"Would you suggest adding, then: 'The duties of such Committee shall be defined by the Council, but their specific work shall be—'?"

Mr. Livermore—"Well, leave the rest of it to them."

Chairman—"Yes."

Mr. Livermore—"I do not think we want to make the Committee too absolutely inflexible."

Chairman—"No, we do not wish to make it so rigid it will not be a pleasure to work under. Any further suggestions?"

Charles L. Parker—"Would it not be well to give the Council a certain amount of latitude in the appointment of their committees? That is, so far as we can now foresee we have recommended certain committees to them; but supposing we put in a clause that the Council may appoint such other committees as they deem it advisable in the best interests of the Association."

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Chairman—"You would add, after the last committee mentioned—Committee on Research—and any other committees they may deem advisable?"

Mr. Parker—"Advisable."

Chairman—"I think that is perfectly all right. Any further suggestions?"

Mr. Durfee—"Well, Mr. Chairman, in the event of the resignation or death of an Officer, is there any provision for his successor?"

Chairman—"Mr. Livermore says he has read over many of these constitutions, but he does not find any. Perhaps you are acquainted with the fact that last year the President of the British Society of Dyers and Colourists died during one month and the Vice-President during the next month?"

Mr. Livermore—"We have two Vice-Presidents to take care of that."

Chairman—"I should think the President would be succeeded by the two Vice-Presidents. In case all three die, I do not know: call a special meeting, I guess."

Mr. Durfee—"Question."

Chairman—"The question before us now is simply on this last change in regard to committees. All those in favor of making it possible to add other committees, say 'Aye.' It is a vote. Any further suggestion on this?"

Mr. Amsden—"Mr. Chairman, I would like to ask you for an opinion. As the instrument is now before us, does it permit the activities of this society to be directed exclusively by the Council, or is it possible for a member to bring matters before the society on his own initiative and get action?"

Chairman—"I do not think any direct provision is made for that, although I should suppose that a matter of that kind should be brought to the Council. That is, if it is a matter involving finance or anything of that kind."

Mr. Amsden—"Finance, or any other activity of the Association."

Chairman—"What should you say about that, Mr. Livermore?"

Mr. Livermore—"I should say, as the matter now stands, there is no direct provision for the action the gentleman speaks of. I do not know that I have seen the activities—the field of activities of the Association, I think, fairly well defined; but if the Council is incompetent or does not carry them out, you will have to elect a new Council; or if the Council did not work you would have to amend the constitution to make it work."

Chairman—"Does that answer the question?"

Mr. Amsden—"Mr. Chairman, that answers the question, but I have a feeling that there should be some provision whereby members of the Association should be able to bring matters before the Association for its consideration and action, if such a thought or such a course of procedure had not been initiated by the Council. We expect to put the very best men in the Association on the Council, but it is possible some of our lay brothers may

have ideas that would be very valuable to bring before the Association, and it is too bad there is no provision for such suggestions to be brought up unless the Council sees fit to act on them in a favorable manner."

Mr. Livermore—"I wonder if our provision as to annual meetings would not cover that? Of course, it is proper for any member to bring any matter before the annual meeting. I think the point that you bring out has merit, as I see it, but I do not know of any provision that I have ever seen anywhere to bring such a thing out. It would be entirely competent for any local Section, at any meeting, to bring up such a matter, and certainly the vote of any local Section in such a matter would have great weight with the Council."

E. H. Killheffer—"I do not know what Mr. Amsden has in mind when he speaks of matters to be brought before the Association. Personally, if there was inserted in the constitution, as there is in many constitutions, an order of business, it might cover his thought, because it would then provide for the order of business, including new business, and therefore you could bring up almost anything."

Chairman—"That is a suggestion. In order to get action on this, suppose we put it to a vote whether Mr. Livermore and his committee, during the dinner hour—"

Mr. Livermore—"No, not during the dinner hour."

Chairman—"After the dinner hour—well, at some convenient time—we will put it that way—introduce a clause which will cover the difficulty."

Mr. Livermore—"May I ask Mr. Amsden if it will cover the difficulty if we provide, at an annual meeting, that any member shall have opportunity for the introduction of any new business?"

Mr. Amsden—"Possibly I have not made myself very clear, but I notice all of your committees are appointed by the Council, and their activities are directed by the Council. It seems to me all the works of the Association are absolutely initiated by the Council, with no opportunity for any member to do anything in the line of intelligent work, except possibly at the annual meeting. That may possibly be your intention in bringing your constitution as you have. That is a thing I thought of, and I mentioned it."

Mr. Livermore—"Perhaps I might answer that as well as I can. It was not found advisable for the Association, as a whole, to meet more than once a year; therefore it would be very difficult for the Association as a whole to take up new business that may be suggested by a member at any time. The hand of the Council—which we hope and trust will meet fairly frequently—is left entirely free, and at the same time any activity any member may wish to bring up would be taken care of in any local Section. The Association as a whole is not going to be able to do many things by direct vote of its membership, on account of the fact they meet only once a year. Does that cover at all your feeling?"

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Mr. Amsden—"I think that covers the thought I had in mind, and I hope it will not lead to any further discussion unless someone wishes to discuss it, because it seems to me perfectly clear now. At an annual meeting any member may bring up anything he chooses."

Mr. Livermore—"Nothing to hinder him."

Chairman—"Then, we will not discuss that matter any further."

"Now, here is a point which arises, rather difficult to act on: We have not accepted this constitution, which provides for certain officers, and our next order of business is the election of officers."

Mr. Durfee—"Mr. Chairman, would it not be proper to move the acceptance of this constitution as offered and phraseology as amended at this time, subject to such amendments of phraseology as may be accepted at the continuance of this meeting on this day? That will make the constitution in effect and will make it possible to amend phraseologies at the continuance of this meeting after dinner, or at any time after we have elected our officers, and have time to consider it. The constitution will then be adopted as a whole, and also we will authorize the amendments in phraseologies provided at this meeting. I therefore move that the constitution be accepted as it stands, with such amendments as to phraseology as we may determine upon."

Mr. Robbins—"I second it."

(The motion was thereupon put to a vote and carried.)

Chairman—"Our next business is the report of the Nominating Committee, and I would say that the Nominating Committee and the Committee on Inaugural Meeting were combined under Mr. Durfee's guidance, as a very efficient Chairman. We will now hear from him."

Mr. Durfee—"The Chairman's statement probably explains why I have been ornamenting the front part of the room. At his request I take charge of the meeting at this juncture."

"We propose to nominate for President, Louis A. Olney; for Vice-Presidents, William D. Livermore and William H. Cady; for Secretary, Walter E. Hadley; for Councilors, Walter M. Scott, George A. Moran, William K. Robbins, Arthur E. Hirst, Elmer C. Bertolet and James L. Amsden. What is your pleasure in regard to these nominations?"

Mr. Livermore—"May I suggest that you divide our Councilors according to the provision in the Constitution for three years, two and one years?"

Mr. Durfee—"I was going to suggest that after the election the division could be made by lots. We did not see how it could be done otherwise." [See footnote.]

Mr. Moorhouse—"I note that the report of the Nomi-

nating Committee mentions no one for Treasurer. As a member of that Committee I would like to present the name of Winthrop C. Durfee for Treasurer."

Mr. Durfee—"Well, I knew that was coming." [Laughter.] "But it makes me think of the story of the two watches. I went over the list three times with Prof. Olney, but we could not find anybody who was willing at the present juncture to take the burdens of the Treasurership. As Prof. Olney and I have been working very closely in this thing, I, at his suggestion, consented to take it."

"I am the only person on this list of officers who is not actively engaged in dyeing and finishing; that is to say, the officers as I have read them are all directly connected with various branches of the textile coloring industry."

"As I was going to say in regard to this Treasurership; there was a man who was going to have a watch given to him. They were going to have it very spontaneous, so they got off in the corner and one listened to the presentation speech while the other made it. When they got up before the company, one said, 'Here's your watch.' The other said, 'Oh, this is the watch!'" [Laughter.] "So that is about all we can do."

"What shall we do with these nominations? Shall they be elected by ballot or acclamation?"

Several Voices—"By acclamation."

Mr. Durfee—"Are there any further nominations?"

"Well, all of those in favor of the list as read being declared officers for the following year signify by raising your hands. They are elected."

"As Chairman of the Nominating Committee I want to explain that our Committee selected these men who have been elected for a purpose."

"It is perfectly obvious that Louis A. Olney, who really started this thing; organized it and did the pioneer work in bringing us together for our first meeting; on account of his very high position in technical matters, and his connection with textile manufacturing, should be nominated for the first President."

"William D. Livermore is the man who has presented your Constitution, and has given much careful study to various constitutions and the working under them of similar societies in England and in this country. He has put much time into this, and we are indebted to him for the work he has done and the clear insight he has shown as to the equilibrium that must be maintained in a Constitution to achieve success. In the second place, Mr. Livermore, as you all know, is one of the most experienced chemists in the United States. He represents the largest interests in the woolen industry."

"William H. Cady not only represents the cotton industry chemically and technically, but geographically; he has done a great deal to help us with the organization and membership in the districts of southern New England. Therefore we have named him as one of the Vice-Presidents."

"Walter E. Hadley, who was appointed Temporary

[Note—In accordance with the suggested plan the Secretary at a later date drew lots, with the following results: Councilors for One Year—James L. Amsden and Walter M. Scott. Councilors for Two Years—William K. Robbins and George A. Moran. Councilors for Three Years—Elmer C. Bertolet and Arthur E. Hirst.]

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"I had forwarded no communication to the Society, and it seems rather a strange coincidence that this letter should have been received just as it was. If I had left for Boston a few minutes earlier we should not have had the benefit of it at this time.

"This communication is gratifying because I believe that much can be done by our organization, even in international co-operation.

"Shall we take any action in regard to this letter, or is it a matter that should be left to the Council?"

Mr. Durfee—"It does not call for action, I hardly think, at the present time."

Chairman—"No, it calls for no action at all, except the indication upon the part of this meeting as to our willingness to co-operate. Any further suggestions in regard to this letter?"

Mr. Robbins—"It seems to me it would be a graceful act for this newly organized society to send some greeting to the older one in recognition of that letter."

Chairman—"Would you make that as a motion, Mr. Robbins?"

Mr. Robbins—"Yes."

Chairman—"Mr. Robbins moves that the newly organized American Association of Textile Chemists and Colorists send greetings to the Society of Dyers and Colourists of England, and assure them of its co-operation in every possible way."

The motion was seconded by Mr. Moorhouse and unanimously passed.

Chairman—"We have ten minutes before we will be requested to adjourn. We have much that might be discussed in the way of future plans for the organization, formation of Sections, and so on. In planning this meeting it was first suggested that we might possibly have an address. It was decided, however, that practically all of the time would be occupied in business, and it was inadvisable to attempt any other program at this time. It was thought, however, that there would be an opportunity for those present to express themselves in regard to future plans for the Association, and make suggestions. I am sure the newly elected Council would be pleased to receive your suggestions and any formulation of plans."

Chairman—"There is one Committee we thought of hearing from later, but I think there will be time before we adjourn for dinner. That is the Committee on Publication, of which Mr. E. H. Killheffer is Chairman."

Mr. Killheffer—"I will read the report of the Committee on Publicity and Publications."

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS:

Gentlemen—Your Committee on Publicity and Publications unanimously recommends the adoption of the proposal submitted by Mr. Howes of the AMERICAN DYESTUFF REPORTER as embodied in his letter of September 27, copy of which is attached herewith.

Your committee believes that the proposal is a very advantageous one for the Association in that it provides us

with a medium, or organ, immediately without cost.

Respectfully submitted,

(Signed) E. H. KILLHEFFER,
Chairman, Committee on Publicity and Publications.

Mr. Killheffer then read the letter referred to in the above report, as follows:

September 27, 1921.

DR. E. H. KILLHEFFER, CHAIRMAN,
COMMITTEE ON PUBLICITY AND PUBLICATIONS,
AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND
COLORISTS, PASSAIC, N. J.:

As you possibly know, the AMERICAN DYESTUFF REPORTER has taken a very active interest in the formation of the proposed Association of Textile Chemists and Colorists. Now that this Association is about to become a reality, the writer is anxious that The REPORTER should continue to co-operate in every way possible toward making the Association a complete success.

In this connection it occurs to me that we might be of service to the Association, during its infancy at least, by offering a portion of our pages to the Association for the purpose of carrying to its members reports of its meetings, committees, technical papers and such other matters as would ordinarily be contained in the journal of such an organization.

With this idea in mind I beg to make to you, as Chairman of the Committee on Publicity and Publications, the following offer on behalf of the Howes Publishing Company, publishers of the AMERICAN DYESTUFF REPORTER:

For a period of six months from the formation of the proposed Association we will place at its disposal a sufficient number of pages in the technical issues of the AMERICAN DYESTUFF REPORTER to carry all the material which the Association deems it advisable to print and distribute to its members. The form of the type matter and general arrangement of these pages can be supervised and directed by any one whom the Association may designate as editor, or, if the Association prefers, we shall be glad to assume such supervision under the general direction of the proper officers. These pages can be kept as a separate section, distinct from other text pages in The REPORTER. During this six months' period we will agree to carry the name of every member of the Association upon our mailing list. For this service we will make no charge whatever.

At the expiration of six months, if the Association is satisfied with this service and desires us to continue it, we shall be glad to do so on a basis which will provide that the Association reimburse us for the actual cost of printing and distributing the text matter involved.

This suggestion is, of course, merely in skeleton form and is susceptible of modification or amplification, as the exigencies of the situation may dictate. The thought which I wish to convey is that we should be glad to relieve the Association of any expense incident to its pub-

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lications for a period of six months and to continue the service thereafter at actual cost, if it is so desired.

The writer is prompted to make this offer because he presumes that the Association will wish to have some official means of keeping its members advised as to its proceedings but that financial limitations, during its infancy, will hardly warrant the expense incidental to the publication of its own journal.

Trusting that your Committee will give this offer consideration and advise me in due time of your decision in the matter, I am,

Faithfully yours,
(Signed) A. P. HOWES,

President, HOWES PUBLISHING COMPANY.

Chairman—"You have heard Mr. E. H. Killheffer's report. I might say, in this connection, and I think we will all agree that eventually an association of this kind should have a journal of its own. The expense, however, of publishing such a journal is very great at the outset, and involves complications which we could not very well handle. I do not think we are in a position to attempt any such an undertaking at the present time ourselves. The only alternative would be to associate with some one of the current publications. The AMERICAN DYESTUFF REPORTER apparently is the only journal that has made an offer of this kind, and it seems to me that it would be fitting that we should use that particular publication under those conditions if it is recommended by the Committee."

Mr. Killheffer—"I want to say, Mr. Chairman, the Committee, at the time we met, did consider other publications than this one, but it did not feel that there was any publication that was any better. Combined with that, of course, as a fact, we did not have any such offer from any other publication, which was quite a material factor in the action of the Committee."

After a brief discussion the following motion was presented by Mr. Hobby: "I move the report be accepted as presented. I see no reason why the services of that particular journal should not be accepted, in view of the fact there is no better offer."

Mr. Durfee and Several Voices—"Second the motion."

Chairman—"Is there any further discussion?"

There being no further discussion, the motion was put to a vote and carried.

Chairman—"It is rather a sad state of affairs that there should be a split in an organization of this kind right at the start, but this room will provide for only about 120, I believe, and there is something more than that here. A suggestion has been made by Mr. Durfee, and I will let him make it himself."

Mr. Durfee—"We are all to come back here at six o'clock except the children. The children will have a side table in the nursery, and will include the recently elected council and all members of the Organization Committee who are present.

"The purpose of sending them off by themselves is that

they may discuss further business of the Association, a little more quietly, and discuss those things which are for the benefit of the Association at this time. So we will send them off to one side, and the rest of us will sit down here and enjoy ourselves when the proper time comes."

Chairman—"You have heard Mr. Durfee's instructions. I hope, in the next hour, we can all gather in the various rooms of the Club for a social time, and then come together for dinner in this room or the one above about six o'clock. Notice will be given to you when the tables have been properly prepared, meanwhile, we will adjourn."

(The meeting was thereupon adjourned.)

At 7.45 P. M. the meeting reconvened with the President in the chair. He said: "In the notice of this meeting it was specifically stated that if possible the evening session would adjourn early enough for those present to attend the Textile Exposition of they so desired. With this in mind we will push the remaining business along as rapidly as possible.

"The most important business is the adoption of the Constitution in its finally approved form. We will hear from Mr. Livermore, Chairman of the Committee."

Mr. Livermore stated that, since the adjournment of the afternoon session, the Committee had incorporated into the original draft such changes and additions as were voted. He then read such sections as had been changed in any way and without discussion the Constitution was adopted in the form as printed immediately following these minutes.

Mr. Chairman—"In making plans for this meeting, the Committee considered the advisability of having several papers presented, or of some one making an address, but it was finally decided that at this first meeting the necessary business would be sufficient to more than occupy the entire time.

"At my suggestion, Wallace J. Murray of A. D. Little, Inc., prepared a paper entitled, "Differential Reduction of Vat Dyes," and had this in readiness to present in case the plans of the Program Committee had developed in this direction. I have the paper before me at this time, and it is a pleasure to read it by title, as the first paper presented before the American Association of Textile Chemists and Colorists. It will be officially published as such as early as possible in our proceedings. (Note.)

"I hope that our members will at all times keep in mind the fact that one of their important duties will be the writing and presentation of papers upon any interesting or valuable work they may be doing, and upon any subjects which they believe will be of value and interest to others."

After the President had briefly outlined some of the other possible activities of the Association, the meeting was adjourned subject to the call of the Council.

[Note—Owing to the large amount of material for publication incident to the inaugural meeting, publication of this paper will be deferred until January.]

Constitution of the American Association of Textile Chemists and Colorists

I

The name of this organization shall be the American Association of Textile Chemists and Colorists.

II

The object of this organization shall be:

To promote increase of knowledge of the application of dyes and chemicals in the Textile Industry.

To encourage in any practicable ways research work on chemical processes and materials of importance to the Textile Industry.

To establish for the members channels by which the interchange of professional knowledge among them may be increased.

III

Membership

Active membership shall consist of persons who shall be not less than twenty-six years of age, and shall have had at least five years' experience as textile chemists, or as chemists otherwise directly concerned with the application of dyestuffs, dyers, bleachers, or finishers. Such persons must, at the time of their election, be engaged in work related to the application of dyestuffs, or to bleaching, or textile finishing.

Active members only shall have the right to vote in the business of the Association.

Junior members shall be persons of less experience than defined above, but engaged in the same occupation; or students in technical institutions of established standing, who are following courses leading to entrance into the occupations mentioned for active membership.

Applications for membership, or junior membership, shall be transmitted in writing to the Secretary. Such applications shall be accompanied by the names of two members of the society who are prepared to certify to the Secretary as to the training, experience, professional attainment, and standing of the applicant; and shall also be accompanied by a concise statement from the applicant of his professional training and experience. In lieu of the above, student applicants for junior membership may be certified to the Secretary by the head of the chemical department of a technical institute of established standing.

IV

At stated periods the Secretary shall mail to the members a list of all applicants together with the names of the members who certify to them. Any member may file with the Council a statement of any objection which in his opinion exists against an applicant. At the end of thirty days the Council shall vote on the applicants, a three-fourths vote being required to elect.

V

For misuse of the privileges of membership or conduct unbecoming a member in the opinion of the Council a two-thirds vote of the Council may expel any member of the Association.

VI

Annual dues shall be \$5, but this amount, or the condition of payment, may be changed at any time for the succeeding year by a three-fourths vote of the Council. Dues are payable in advance on November 1 of each year. If, however, a member is elected on or after September 1 no dues shall be required for the current year.

VII

Members whose dues are in arrears on March 1 of any year shall have notice sent them and unless payment is made by May 1 they shall cease to have any right or privilege in the Association. Such members may, however, be restored to the rights and privileges of the Association on full payment of dues by a vote of the Council. Resignation shall be accepted at any time from members whose dues are fully paid.

VIII

Officers and Council

The officers of this Association shall be elected at an annual meeting called in December by the Council, and shall be a President, two Vice-Presidents, a Secretary, a Treasurer, and six Councilors. All of the foregoing shall be members of the Council which shall be the governing board of the Association. A retiring President shall also be a member of the Council for one year after the election of his successor, and the Chairmen of local Sections shall be members of the Council *ex officio*.

The President, Vice-President, Secretary, and Treasurer shall be elected for one year. Two Councilors shall be elected for three years, two Councilors for two years, and two Councilors for one year at the first election of officers. Thereafter the officers and two Councilors shall be elected each year and the retiring officers and Councilors shall be eligible for re-election.

Excepting the first election, Councilors shall be elected for three years. After the first election the election of officers shall be by letter ballot. The Secretary, at least eight weeks prior to every annual meeting, shall send to every member of the Association a blank nominating ballot upon which the members may make nominations for the officers and Councilors to be elected at the coming annual meeting. The nominating ballots to be valid must be made out, signed, and transmitted to the Secretary not later than five weeks prior to the annual meeting. The Secretary shall then prepare and issue an official

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ballot upon which shall appear the names of all nominations for officers, and Councilors, which shall have appeared upon at least ten nominating ballots. The official ballot shall be mailed not later than three weeks prior to the annual meeting, to each member, who shall signify his choice for the various offices and Councilors, and return it to the Secretary. At the annual meeting the President shall cause the ballots to be opened and counted and the vote announced. The officers elected shall take office immediately.

IX

The Council shall have supervision and care of all property of the organization, and shall conduct its affairs according to the Constitution. At each annual meeting it shall present a report of its proceedings during the year.

Meetings of the Council may be called by the President through notice from the Secretary, and five members shall constitute a quorum.

X

The Council may appoint committees to have charge of special affairs as follows: Finance Committee, Committee on Membership, Committee on Meetings, Committee on Publication, Library Committee, Committee on Research, and such other committees as they may deem advisable. Such committees may be made up from the Council, or from the general membership, or both. The fields of duty of the committees shall be defined by the Council.

XI

The Council is authorized to arrange on such terms as it may find desirable for co-operation with the Textile or Color Industries, their societies or corporations, for the purpose of carrying out such investigations or such forms of standardization of products or methods as may be mutually regarded as valuable to the progress of these industries.

XII

Proposed amendments to this Constitution, signed by at least ten members, must be presented in writing to the Council at least four weeks before the next annual meeting. In the notice for this meeting the proposed amendments shall be printed. At the annual meeting the proposed amendment may be discussed and amended and may be passed to letter ballot by a two-thirds vote of those present.

If two-thirds of the votes obtained by letter ballot are in favor of a proposed amendment, it shall be adopted.

The Council is authorized to number the Articles and Sections of the Constitution to correspond with any changes that may be made.

Relating to Sections

XIII

Twenty-five or more members residing in any district may notify the Council of their desire to form a local Section. Whenever this is done, if in the opinion of the Council the formation of such a Section is desirable, the Council shall designate the geographic limitation of the

district and nominate a Secretary *pro tem*, who shall call a meeting of all members in that district. This meeting shall decide as to whether a local Section shall be formed.

XIV

In case it is decided to form a local Section, a first formal meeting shall be called by the Secretary *pro tem*, at which the Section shall elect a local Chairman, a local Treasurer, a local Secretary, and four members of a Sectional Committee. The local Chairman shall become *ex officio* a member of the Council of the Association.

XV

Members engaged in business or professional pursuits in the district of a local Section shall be regarded as belonging to that Section, except that any member, who shall signify his desire in writing to the Council, may be a member of any Section that he may elect.

The Sectional Committee shall consist of four elected members of the Section together with the President, Treasurer and Secretary and shall constitute the governing board of the Section.

The local Secretary shall submit to the Secretary of the Association before February 1 in each year a report of the proceedings of the local Section.

A Sectional Committee shall not be entitled to spend in any one year more than a sum represented by \$1 per member affiliated with the Section for the year in question. All expenses of the Section shall be paid by the Treasurer of the Section. Funds for payment of such expenses shall be furnished up to the amount of \$1 per member affiliated with the Section, by the Treasurer of the Association on receipt of bills approved by the local Treasurer. The local Treasurer shall furnish the Treasurer of the Association with an annual account of expenses each year before February 1 of the succeeding year.

No Sectional Committee shall spend any sum, or incur any financial liability in excess of the amount stated in the foregoing, except on a grant obtained by special vote of the Council.

The Secretary of a local Section shall send an account of every meeting of the Section to the Secretary of the Association.

XVI

When a Section no longer has a membership of twenty-five or more, or in the opinion of the Council is no longer properly representative of the purposes of the Association, the Council by a two-thirds vote may dissolve such Section.

XVII

Whenever a Section shall vote at a regular meeting to dissolve, it shall be dissolved thereby. All money or property in the treasury thereof shall become the property of the general Association and be accounted for by the local Treasurer to the Treasurer of the Association. But no vote of dissolution shall be taken unless a notice shall be sent to each member of the Section at least one month previous to the meeting at which the vote is to be taken

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COUNCIL MEETING

THE first meeting of the Council of the American Association of Textile Chemists and Colorists was held Friday, November 18, at the Engineers' Club, Boston, Mass.

The following were present: Prof. Louis A. Olney, President; Wm. D. Livermore and Wm. H. Cady, Vice-Presidents; W. E. Hadley, Secretary; W. C. Durfee, Treasurer, and Geo. A. Moran, Walter M. Scott, A. E. Hirst and Wm. K. Robbins, Councilors. Letters were read from Prof. E. C. Bertolet and J. L. Amsden, who were unable to be present.

Among the important matters considered were:

The formation of the various committees authorized by the Constitution, and the nature of the work to be undertaken by each.

The formation of local Sections in general, and of a Providence Section in particular.

Discussion as to general character and form of membership application blanks.

Discussion as to status of junior members and junior branches.

The matter of the publication of the proceedings of the Association.

COMMITTEES

It was voted that the Research Committee should consist of the present Council of eleven members, with four additional members, and such further additions in the future as might be deemed advisable.

The four additional members chosen were: Wm. R. Moorhouse, Dr. R. E. Rose, Ed. F. L. Lotte, Dr. W. J. Murray.

The above Committee is to have supervision over all of the research work done by the Association, delegating and distributing the same to various members of the Association best fitted for such work, and to other agencies when thought desirable.

The personnel of the Research Committee is such as to include all branches of textile chemistry and textile coloring as related to the cotton, wool and silk industries, also the technical side of the dyestuff industry and general research work.

It was also voted that for the time being the work of standardization could be under the supervision of the Research Committee.

It was decided to hold the first meeting of the Research Committee directly following the next meeting of the Council, on Friday, December 9.

The formation of the Finance Committee was deferred until a later date, the Treasurer to handle all money matters at present.

It was voted to combine the Library and Publication Committees as one and retain the original Publication Committee consisting of E. H. Killheffer, as Chairman, and W. E. Hadley and F. C. Holden as the other members.

It was voted that the Committee on Meetings should consist of the President, the two Vice-Presidents, the Secretary and the Treasurer.

It was voted that the Committee on Membership and Local Sections should consist of the six elected Councilors and the Secretary, and that their first meeting should be held on the same date as the next Council meeting, when a chairman could be elected.

All of the above committees are to serve for one year.

The form of membership application blanks was discussed and final details left in the hands of the President and Secretary. These blanks are now ready for distribution.

While it was thought desirable by some of the members of the Council that dues for junior members should be somewhat reduced, over those of active members, it was decided that according to the Constitution this could not be changed until the expiration of one year.

It was voted that L. A. Olney, President of the Association, be appointed to officially represent the American Association of Textile Chemists and Colorists in any work of co-operation with the Color Laboratory of the Bureau of Chemistry, Department of Agriculture, Washington, D. C., of which Dr. Jos. A. Ambler is Director.

Letters were read from Councilors Prof. E. C. Bertolet and J. L. Amsden, the latter suggesting that work be instituted as soon as possible on the standardization of the fastness of colors.

Wm. H. Cady presented a petition signed by twenty-six members of the Association requesting approval for the formation of a local Section in Providence, R. I. It was voted to authorize such Section, and Wm. H. Cady was appointed Secretary *pro tem*. The geographical boundaries of the section were designated as the State of Rhode Island.

It was decided that the formation of a local Junior Section to incorporate the present Alembic Society of the Lowell Textile School could be authorized by a local Section of the Association when formed.

The matter of publication of the proceedings of the Association was discussed.

It was decided that all articles referring to research and standardization must undergo the closest scrutiny of the Research Committee before publication.

The matter of incorporation of the Association was discussed and left for the President to secure further information and report at the next meeting of the Council.

NOTICE OF MEETINGS

The next meeting of the Council will be held Friday, December 9, at the Engineers' Club, Boston, Mass., at 3 P. M. A meeting of the Research Committee will be held at the same place at 4 P. M. of the same day. Members wishing to bring any matters to the attention of the Council are requested to communicate with either the President or Secretary prior to that time.

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FORMATION OF RHODE ISLAND SECTION

At the recent Council meeting of the American Association of Textile Chemists and Colorists, held in Boston, November 18, a petition was presented by Wm. H. Cady, requesting permission to form a local Section with headquarters in Providence.

The aforementioned petition was couched in the following phraseology and signed by twenty-six active members of the Association:

TO THE COUNCIL OF THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS:

We, the undersigned charter members of the Association, desire to organize a local section at Providence, R. I., and hereby request your official approval, as required by the constitution of the Association.

(Signed) W. P. WRIGHT, WM. H. CADY, A. E. HIRST, BEN VERITY, J. H. HINDLE, W. J. JOYCE, ROBERT K. LYONS, JOHN C. WATSON, NELSON BARLOW, FRED H. WEBSTER, JAS. K. HACKING, FRED T. PHILLIPS, H. P. RENO, EDGAR R. FORD, H. F. SCHWARZ, J. P. VANSLETTO, J. HUTTON, C. H. CHURCH, L. B. WOOD, P. J. ARIENTE, ALFRED L. LUSTIG, HENRI N. F. SCHAEFFER, WILLIAM MILVE, CHARLES MILNES, JOHN W. CLARK, FREDERIC C. CUSHING

The Council, in executive session, duly approved the petition, and in accordance with Article XIII of the Constitution proceeded to elect as Secretary *pro tem* Wm. H. Cady, granting him power to proceed with the formation of the local Section.

It was decided that the geographical boundaries of the Section should be the State of Rhode Island.

It was pointed out that besides including members within the confines of the State of Rhode Island, that in accordance with Article XV of the Constitution, it would be permissible for members outside that State to join such local Section.

It is worthy of note that this request represents the first to be received by the Council, and it is confidently expected that the enthusiasm herein shown is indicative of the spirit which will soon be manifest throughout different sections of the country.

It is through the formation of local Sections that the strength of the Association will increase, and it is the firm conviction that the spirit manifested by the members in Providence and vicinity will be rapidly reflected in other localities and that we may soon hear of the formation of several Sections.

NOTICE FROM THE SECRETARY

In view of the large number of names and addresses of members inserted in this issue it is quite possible that errors or omissions may have occurred.

It is requested that charter members examine their names carefully and, if errors are noted, communicate at once with the Secretary, in order that his records may be accurate and complete.

WALTER E. HADLEY, Secretary,
5 Mountain Avenue, Maplewood, N. J.

Names and Addresses of Charter Members

Adams, E. W. Lewiston Bleachery & Dye Works Lewiston, Me.	Atwood, William P. Massachusetts Cotton Mills Lowell, Mass.	Bertolet, Elmer C. Philadelphia Textile School Philadelphia, Pa.
Adams, Tracy Arnold Print Works North Adams, Mass.	Bailey, Sidney Kraemer Hosiery Co. Nazareth, Pa.	Biach, Ludwig, Dr. Southbridge Printing Co. Southbridge, Mass.
Ainslee, Thomas D. Roessler Hasslacher Chemical Co. Perth Amboy, N. J.	Bailey, Walter J. Bayburn Cleansing Shop Cambridge, Mass.	Biery, Frank W. Pacific Mills Lawrence, Mass.
Alderman, C. Nelson Bradford Durfee Textile School Fall River, Mass.	Bannan, John F. M. T. Stevens & Sons Co. North Andover, Mass.	Biery, Thomas J. Pacific Mills Lawrence, Mass.
Amsden, James L. Rockland Finishing Co., Inc. Garnerville, N. Y.	Barlow, Nelson U. S. Finishing Co. Pawtucket, R. I.	Blake, K. B. Cheney Bros. South Manchester, Conn.
Arienti, Peter J. Glenlyon Dye Works Saylesville, R. I.	Barrington, James L. Geigy Company 88 Broad Street, Boston, Mass.	Bond, B. C. 84 Pleasant Street Portsmouth, N. H.
Ashbrook, Donald S. Joseph Bancroft & Sons Co. Wilmington, Del.	Bastow, Stephen W. Nashua Manufacturing Co. Nashua, N. H.	Brainerd, A. T. H. A. Metz & Co., Inc. 449 West La Salle Street Chicago, Ill.
Aspinall, George W. Washington Mills Lawrence, Mass.	Behm, Albert S. Slater & Sons Co. Webster, Mass.	Brown, Arthur R. Schirreffs Worsted Co. Fitchburg, Mass.

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- Brown, G. Winslow
Assabet Mills
Maynard, Mass.
- Bume, Louis F.
Ayer Mills
Lawrence, Mass.
- Busby, Fred E.
New Bedford Textile School
New Bedford, Mass.
- Busby, H. S.
Cheney Bros.
South Manchester, Conn.
- Butterworth, William
I. Levinstein & Co., Inc.
281 Franklin Street
Boston, Mass.
- Cady, William H.
U. S. Finishing Co.
Providence, R. I.
- Carr, Walter W.
Pacific Mills
Lawrence, Mass.
- Carter, Robert A.
E. I. du Pont de Nemours & Co.
210 North Broad Street
Philadelphia, Pa.
- Cathcart, W. R., Dr.
Corn Products Refining Co.
17 Battery Place
New York
- Chapin, Ed. S.
c/o Winthrop C. Durfee
516 Atlantic Ave.
Boston, Mass.
- Chase, Harold M.
Riverside & Dan River Cotton Mills
Danville, Va.
- Chase, R. L.
Eddystone Print Works
267 Fifth Avenue
New York
- Cheney, F. D.
Cheney Bros.
South Manchester, Conn.
- Christison, Hugh
Arlington Mills
Lawrence, Mass.
- Church, Charles
Sayles Bleacheries
Phillipsdale, R. I.
- Claflin, Alan A.
L. B. Fortner Co.
102 Pearl Street
Boston, Mass.
- Clark, J. W.
Wanskuck Mill
Providence, R. I.
- Clarkson, Philip S.
H. A. Metz & Co.
122 Hudson Street
New York City
- Clogston, Raymond B.
Merrimack Manufacturing Co.
Lowell, Mass.
- Coan, Charles B.
1300 Boston Road
Ward Hill, Mass.
- Colonel, J. P.
Cleveland Worsted Mills Co.
2555 Broadway, Cleveland, Ohio
- Conley, Leander F.
Lawrence Manufacturing Co.
Lowell, Mass.
- Craig, Albert W.
Windsor Print Works
North Adams, Mass.
- Creaser, J. H.
Arlington Mills
Lawrence, Mass.
- Crowell, Prince S.
National Aniline & Chemical Co.
113 High Street, Boston, Mass.
- Culver, John H.
Firth Carpet Co.
Firthcliffe, N. Y.
- Culver, R. F.
Box 269
Providence, R. I.
- Cushing, Frederick C.
Geneva Mill
Geneva, R. I.
- Daignault, H. Joseph
National Aniline & Chemical Co.
21 Burling Slip, New York City
- Dalton, John N.
Atlantic Mills
Providence, R. I.
- Dannerth, Frederic
Textile Trade Laboratory
96 Academy Street, Newark, N. J.
- Darling, Elton R.
James Milliken University
Decatur, Ill.
- Davies, Harry R.
I. Levinstein & Co.
281 Franklin Street, Boston, Mass.
- De Goenoz, Denis
Arnold Print Works
North Adams, Mass.
- Durfee, Walter C.
516 Atlantic Avenue
Boston, Mass.
- Durfee, Winthrop C.
516 Atlantic Avenue
Boston, Mass.
- Duhring, Edwin L.
c/o Charles Enu Johnson
509 South Tenth Street
Philadelphia, Pa.
- Eich, John W.
Newport Chemical Works
68 Devonshire Street
Boston, Mass.
- Estey, Paul F.
Bradford Dyeing Association
Westerly, R. I.
- Everett, John
Pacific Mills
Lawrence, Mass.
- Felton, J. H.
Valkone Dye & Finishing Works
Philadelphia, Pa.
- Fieldhouse, W. H.
c/o F. E. Atteaux & Co.
176 Purchase Street, Boston, Mass.
- Finlay, Harry F.
National Aniline & Chemical Co.
Buffalo, N. Y.
- Fischer, Ralph M.
Hasco Silk Dyeing Co.
Jersey City, N. J.
- Fisher, Jr., Andrew
170 Summer Street
Boston, Mass.
- Fleming, Frank E.
Goddall Worsted Co.
Sanford, Me.
- Ford, Edgar R.
Sayles Finishing Plants
Saylesville, R. I.
- Friedman, Louis
Friedman Dyeing Co.
386 Second Avenue, New York
- Fuller, Robert E.
Jennings & Co.
93 Broad Street, Boston, Mass.
- Gainey, Frank W.
National Aniline & Chemical Co.
Buffalo, N. Y.
- Gates, A. W.
Willimantic Mills
American Thread Co.
Willimantic, Conn.
- Gile, Harold E.
Jennings & Co.
93 Broad Street, Boston, Mass.
- Glennon, Edward M.
c/o Waldorf Hotel
Ludlow, Mass.
- Goldthwaite, Charles F.
Klearflax Linen Rug Co.
Duluth, Minn.
- Graham, John E.
Chemical Company of America
8 Union Street, Providence, R. I.
- Grandage, Herbert
Clark Thread Co.
Newark, N. J.
- Grady, John H.
John Campbell & Co.
33 India Street, Boston, Mass.
- Graves, E. S.
Franklin Process Co.
Providence, R. I.
- Grimes, Henry D.
American Woolen Co.
Washington Mills
Lawrence, Mass.
- Gyzander, A. K.
National Aniline & Chemical Co.
113 High Street, Boston, Mass.
- Hacking, J. H.
U. S. Finishing Co.
Pawtucket, R. I.

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- Hadley, Walter E.
5 Mountain Avenue
Maplewood, N. J.
- Hanson, Fred V.
Lowell Dye Works
Lowell, Mass.
- Harlow, Ivan O.
Arnold Print Works
North Adams, Mass.
- Harold, Joseph F. X., Dr.
Room 98, 50 East 41st Street
New York City
- Haskell, Walter F.
234 Bridge Street
Westbrook, Me.
- Hassett, Paul J.
Remington Typewriter Co.
Bridgeport, Conn.
- Helm, A. S.
Cheney Bros.
South Manchester, Conn.
- Hendrick, Ellwood
139 East Fortieth Street
New York City
- Hinckley, Everett H.
80 South Street
New York City
- Hindle, J. H.
American Printing Co.
Fall River, Mass.
- Hirst, A. E.
American Printing Co.
Fall River, Mass.
- Hobby, Amos K.
c/o Winthrop C. Durfee
516 Atlantic Avenue
Boston, Mass.
- Holden, Frank C.
Chelsea Fibre Mills
1155 Manhattan Avenue
Brooklyn, N. Y.
- Hollander, Charles S., Dr.
Rohm & Haas Co.,
40 North Front Street
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AMERICAN DYESTUFF REPORTER

In Two Sections—Section Two

Devoted to the use and application of dyestuffs and the
mechanical equipment incidental thereto.

LOUIS A. OLNEY

PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL

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A PERIOD OF TRANSITION

THE recent turn of affairs in Washington would almost lead the impartial observer to believe that the American dye industry had been fated to remain in a state of legislative suspense from the very beginning. When, in the Spring of 1919, the case of the industry first came before Congress, estimates of the length of time which would be required for a settlement averaged around five or six months at the outside. Now, with much bitter experience to serve as a basis for calculation, there are those who believe the total length of the period of uncertainty will go down in history as in the neighborhood of four years.

The arguments which may be advanced in support of this view are worthy of consideration. The Sixty-sixth Congress, having found itself unable to reach an agreement at the end of a year, was strongly impelled to bequeath this question to the Sixty-seventh because, among other reasons, it did not wish to have what it regarded as a tariff issue figure in the approaching election. It is no more than logical to suppose that Senator Penrose had some such thought in mind when he repeatedly set his face against immediate action on the particular dye measure being debated at that time. As one of the leaders of his party he foresaw, no doubt, that the Republicans would want to make some sweeping changes in the tariff, and that it would be better, on the whole, to wait until Republican supremacy in both Houses should be assured. Hence his well-remembered protests against "popgun" tariff legislation.

And now that a combination of circumstances has prevented Congressional action to date, and has further made it apparent that hearings and debate on the Fordney bill will not be completed before next Spring or even early Summer, it is pointed out by some that the immediate prospect of another Congressional election

will cause the majority party to refrain once more from finally committing itself until the test of the polls is over and the members of the Sixty-eighth Congress are seated. By that time the Republicans might well be expected to have settled all internal differences having to do with the tariff, and to be primed, therefore, for immediate action. This would result in an end to the whole controversy in the Spring of 1923, just four years after the first Longworth bill was presented.

This, of course, is the extreme view. Yet in the light of what has gone before, no one who has consistently followed the legislative fortunes of the dye industry could feel greatly astonished at its fulfillment. On the other hand, it may be that action is much nearer than would appear, for it is thought by some that President Harding may use his influence to speed the Fordney measure on its way.

In brief, then, the only real certainty is the uncertainty. The past has shown that almost anything can happen. While the case of the dye industry has had many strong and loyal supporters, nevertheless it cannot be denied that many of the ever-recurring instants when the luck element has been in the ascendancy—the so-called "breaks"—have been unfavorable to the cause of those who were working for early action. And again, when all has seemed ready, those in charge of the bill have been balked in their efforts to bring it to a vote—on one occasion by a filibuster which most certainly should have brought about the invocation of the closure rule.

But if Congressional action itself seems yet afar off, a determination of the nature of that action is undoubtedly much nearer. It may precede enactment by almost a year. Hearings on the various provisions of the Fordney bill have been halted for the time being, and the special conference committee of the House and Senate, appointed to recommend dye protection measures to the Senate Finance Committee, will not make its report until after these hearings are resumed. This special committee, it may be recalled, consists of Senators Smoot and Dillingham, and Representatives Frear and Longworth. Senator Smoot was detailed by the others to conduct an investigation into every phase of the international dye situation, with instructions to return his findings to the committee. It is understood that he will present a plan for the regulation of dye imports, based upon his researches. In view of this, his suggestions may be expected to have much weight in determining the subsequent recommendation to the Finance Committee; the latter body, because of the inter-House nature of the special committee, will likely adopt this recommendation substantially as its own recommendation to the Senate when the bill is reported out, and the Senate, in turn, will probably enact the bill substantially in accordance with the views of the Finance Committee. At least, this is as reasonable a conjecture as any, in these days when no one can lay claim to infallible inspiration for prophecy.

Hence, Senator Smoot suddenly looms up as one of the most important figures in the dye controversy, and what he will have to say to the special committee will be

fraught with intense interest. He comes as near to being the real Man of Destiny for the dye and dye consuming interests as any one in either House of Congress.

His plan, he says, is ready for presentation whenever the committee is ready to receive it. The matter of the time, as before noted, is problematical; but at least one part of his plan is not, for he has stated that he will not recommend an embargo of any kind whatever, either permanent or temporary.

That is definite enough, at all events. Representative Frear, as leader of the extremely scant House majority which succeeded in eliminating the embargo plan from the Fordney bill, may be expected to support him vigorously. Senator Dillingham is somewhat doubtful, but has never been an open supporter of the more drastic methods suggested. This leaves Representative Longworth, author of the present debated provision, as the only one who may be expected to furnish a real argument against protection by means of a tariff alone. Whatever compromise, if any, he may succeed in forcing from Messrs. Smoot and Frear is a matter of deep concern. It is unlikely that he will watch the complete abandonment of his plan, which has received much support, without a struggle. It is also unlikely that he, alone, can accomplish much against two such determined antagonists as he must encounter.

At this point it may not be out of place to note that there is some talk in his native State of running him for Senator at the Fall election. It is believed that he would make a strong candidate, and if he should gain a seat among the Solons we should then have the unusual spectacle of a Representative following his own bill into the upper House and supporting it throughout its entire period of debate.

But that, as Kipling might say, is another story. Senator Smoot will recommend some kind of a tariff schedule for the protection of the American dye industry against one of the most ruthless and powerful combines in the world—a combine aided, moreover, by abnormal conditions operating strongly in its favor. Senator Smoot, in order to find support for his series of graduated duties, will have to prove that they cannot be evaded by the numerous chemical subterfuges which the peculiarities of the coal-tar industry make possible—and which the Germans understand only too well how to employ—that these duties will provide against the certain attempt of the Rhine dye makers to sell at a loss in order to render them worthless, and that, while providing for future fluctuations in exchange values, they will not be so high as to impose a needless tax on American dye consumers. Without being able to prove these things, he will have no right to urge his own tariff plan as against the present Longworth plan, which not only prevents evasions of all sorts and enables consumers to get what they need from abroad without paying the exorbitant duties necessary to protect American dye makers if a tariff alone is depended upon, but which, in addition, is a great improvement over the present licensing system, which will be in force until a decision is reached. Many observ-

ers believe that Senator Smoot has imposed upon himself a mighty task—too mighty, in fact, for accomplishment.

The dye consumer, as matters are to-day, stands to lose far more by dependence upon a tariff for dye protection than he would lose by employment of the Longworth plan. Under the latter, duties can be made very low, whereas under the former, if made high enough to protect, they would impose an unnecessary tax upon him. In other words, if tariff duties protect, he must pay high for that protection, and if they fail to protect, he will eventually have to look abroad once more for his supply of colors—and feel that his country is lagging behind others in military preparedness as well. Moreover, if followers of Senator Pomerene, who says it would make no difference to consumers whether they buy from a foreign or a domestic monopoly, desire any further refutation of this, they need only turn to the latest striking example of Governmental treatment of trusts as shown by the jail sentences meted out to some of the members of the Grate and Mantel Manufacturers and Dealers Association. Finally, the Longworth plan would produce no dye monopoly because, wholly aside from the universal realization of domestic ability to deal with such an undesirable incubus, the very nature of its operation is such as to foster, not stifle, healthy competition between American and American, and between American and German or Swiss.

Much of the above has been said before, yet it does no harm to repeat it, with emphasis, at the present time, in company with the most recent developments—which are no developments at all. The legislative situation has truly reached a period of transition. It is about to enjoy a real breathing spell, during which no effort should be relaxed, yet which does not demand the same intensity and strain called forth by committee hearings or actual debate. Therefore, it is not the intention of *THE REPORTER* to enter upon, at the moment, another tedious discussion of what every reader knows by heart. The only sort of comment which the present situation seems to call for is the following:

There is no precedent in industrial history for the case of the dye industry as presented before Congress. Military munitions industries have always been separate from peace-time industries. Never before has a situation arisen where a military and a peace-time industry have blended their identities to the extent of the modern munitions and dye industries.

Therefore, since all past free-trade and protection arguments have been based upon the former condition, they cannot apply to the present case except in so far as they relate purely to the economic phase thereof. Conversely, the preparedness argument cannot apply to this phase, but only to its own. Both must be recognized, and the problem, proceeding on this new basis and discarding all precedent, tradition and partyism, must be attacked afresh with a view to ascertaining how far these two distinct aspects of it can be reconciled and adjusted.

The legislator who cannot, or will not, approach a dye

protection debate in this spirit, will be unable to contribute anything helpful.

It would seem that all interested parties should work to impress this upon their Representatives and Senators during the present period of inaction.

A MENTAL ATTITUDE

FROM the recent speech of A. E. Peak, of the Clayton Aniline Works, England, before the West Riding Section of the Society of Dyers and Colourists, it now appears that when the British passed their Dyestuffs Import Regulation Act of 1920 there was a friendly understanding with the Swiss to the effect that the latter were to be allowed practically unrestricted importation. The speaker went so far as to declare that unless he had been misinformed—for he was but repeating information which had been supplied to him—this was a condition agreed upon between the British Government and the Colour Users' Association when the question of import restrictions was first raised.

At the same meeting, H. Sutcliffe Smith, president of the society, stated during the course of some subsequent remarks that the manner in which the Swiss had maintained neutrality throughout the war, when they were adjacent to three countries actively engaged in the fighting, was magnificent, and that he could say on behalf of all the color users of Great Britain that they would never forget the "deep debt of gratitude" they owed the Swiss for all the latter did during the war. Mr. Smith added that as far as he was concerned, in his connection with the Colour Users' Association, he would try to "translate that feeling of gratitude into action."

All this is most interesting to a country which also owes a very considerable debt of gratitude to the Swiss for their excellent support of our color using industries during the war. More than once has the wish been expressed that if the proposed Longworth plan should be enacted, it might be possible to show as many favors to Switzerland as possible. And more than once has the practical impossibility of thus discriminating—in the law itself—been dwelt upon. This phase of the subject has even been numbered among the reasons against choosing legislation of that particular variety for the defense of our dye industry.

Certain it is that no such discriminatory clause should or could find its way into a law of the land. Any favoritism would have to be a spontaneous action on the part of the dye consumers—who, goodness knows have every reason for gratitude. Yet across the water we find a country which actually did make an agreement to discriminate in favor of one country over another—not by act of Parliament, it is true, but by the action of an organization consisting of the only persons who could exercise such discrimination. This they did even before the passage of a dye regulation law which makes the proposed Longworth measure seem mild by comparison.

It is not our province to discuss the ethics of international commerce. We cite this incident merely to show

how seriously one of the largest textile-producing countries in the world takes the matter of its supply of dyestuffs, as well as its future military safety. Did any one raise the cry that this was "un-English"? If he did, it was not audible on this side of the water. On the contrary, most Englishmen seemed to feel that their first duty was to take care of England, her trade and her defenses. A strange people!

We beg to call attention to the mental attitude, rather than to the specific action. England's lesson from the war was far more bitter than ours; her losses in money, trade and men exceeded our many times over. Small wonder, then, that she has learned, if she did not know before, the most modern ways of taking care of herself in the human jungle wherein we are all obliged to dwell.

NEW BLEACHING APPARATUS

A new method of bleaching cloth in rope form in kiers is described by Charles Taylor in United States Patent No. 1,396,792, issued November 15, 1921. It consists in passing two ropes of cloth simultaneously through a mangle, mechanically introducing into and automatically piling in a boiling kier one of these ropes; mechanically introducing into and automatically piling in a second boiling kier the other rope in a simultaneous manner; boiling the ropes of cloth; withdrawing the ropes and passing them simultaneously through a mangle; mechanically introducing into and automatically piling in a wood kier one of the ropes; simultaneously introducing mechanically into and automatically piling in another wood kier the other rope; treating both ropes in the respective wood kiers; simultaneously withdrawing and expanding the ropes; passing the ropes together through a white mangle, and then simultaneously folding both ropes.

INDIVIDUAL MOTOR DRIVE FOR WET FINISHING EQUIPMENT

By JAMES A. IRVINE, B.T.E.

Manager, Textile Machinery Department, Rodney Hunt Machine Company

PICTURE if you can the interior of a dyehouse on a cold and blustery winter's day, with the absence of water vapor in the air, no belts, pulleys, line shafting, nor piping anywhere visible. These conditions are actually realized in many of the modern finishing plants to-day. One of the most important factors which make these conditions possible is the individual motor drive on wet finishing machines.

One of the big worries of the dyer or finisher is the presence of mineral oil spots on the fabric. This evil is usually traced to oil dropping from the bearings of line shafts being thrown from belts. The improved type of silent chain drive from a motor mounted upon the iron

frames of the machine with the chain properly guarded overcomes this difficulty.

The individual motor drive with friction clutch allows for positive and complete control at all times. The machine can be started or stopped either by the clutch or by a motor switch. Where desired, a double throw switch can be installed, enabling the operator to reverse the direction of the motor and driving parts of the machine.

Highest efficiency results from the use of individual motor drives with the absence of belt slippage and line shaft friction load. With the elimination of all belts better lighting conditions and better working conditions result. The operator is not subject to the dangers of fast moving belts and pulleys.

The motor driven machine is obviously the most reliable and will involve fewer "shut downs." The machine can be set in the most convenient location with respect to light and operation. When it is desired to operate a certain machine overtime this can be done without driving the line shafting and the loose pulleys of other machines.

Figure 1 illustrates an improved motor drive equipment on a standard reel machine used for dyeing woolen, worsted and similar fabrics. Note the construction of the motor plate which is rigidly secured to the cast-iron side frame of the machine. The sliding motor base is used to allow for take-up and adjustment in the chain.

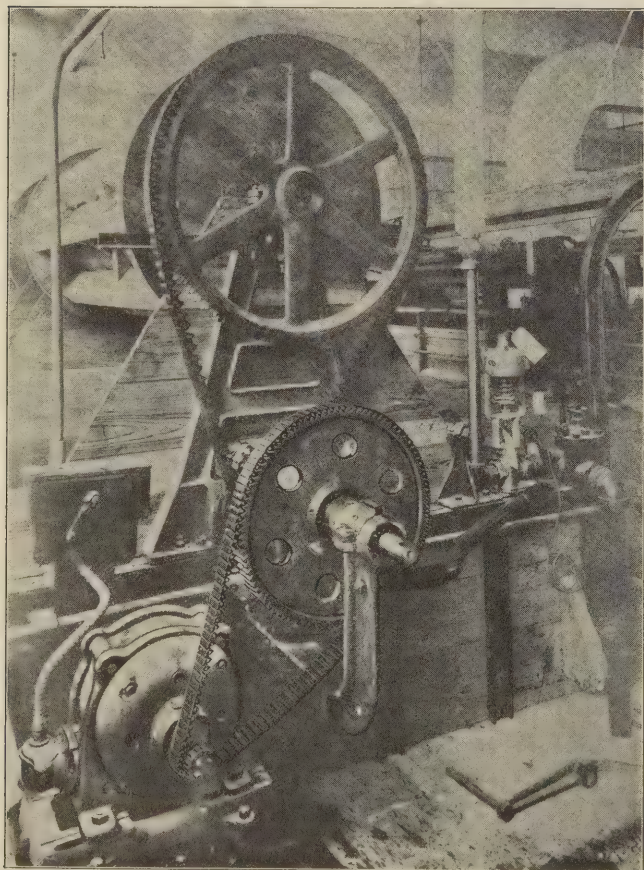


FIG. 1—Individual Motor Drive on Rodney Hunt Reel Machine

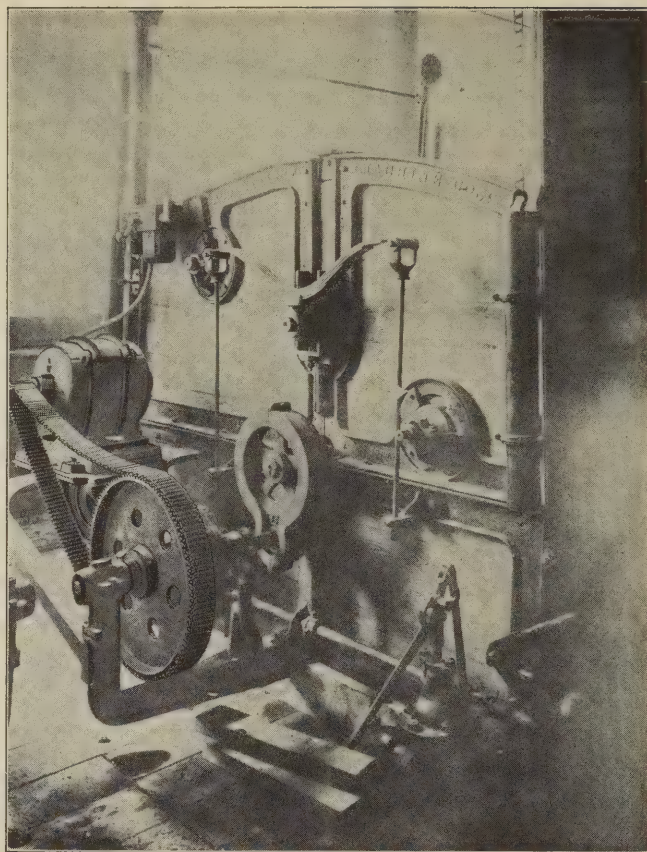


FIG. 2—Individual Motor Drive on Rodney Hunt Washer

Note also the accessibility of the motor and parts to allow for inspection and lubrication.

Figure 2 illustrates an improved motor drive equipment on a standard washer used for washing and scouring woolens, worsteds and such fabrics. A totally enclosed motor is generally recommended for all wet finishing machines, although some companies advocate the use of an open motor with specially impregnated windings. The regular sheet steel guard is always used with silent chain drives.

It might be said that the disadvantages of the individual motor drive are negligible as compared with the advantages. The use of a number of small motors instead of one large one has a tendency in the case of alternating current to lower the power factor in the line, meaning lower efficiency in transmitting the electrical current. The initial expense is a little greater. But the saving in line shaft friction load and in the upkeep in shafting, bearings, belts, etc., is greatly in favor of the individual motor drive.

Briefly the advantages may be summed up as follows:

(1) Reliability, (2) complete and positive control, (3) saving in belts, (4) freedom from oil spots, (5) better light and working conditions, (6) placing machine in most convenient location, (7) overtime operation of one machine independent of others.

WATERPROOFING COTTON DUCK

(Continued from page 16.)

None of these products receives very gentle use, and in spite of the excellent material put into them they do not last very long. The waterproofing is never guaranteed to last forever, but as a general rule it lasts as long as the cloth remains intact.

Unbleached cotton is provided by nature to some extent with waterproofing due to the waxes it naturally holds. Umbrella cloth is rarely waterproofed; umbrellas are generally made up of unbleached cloth which resists the water as far as necessary. The shape of the umbrella is its best protection. If folded up it wets out rather easily.

A really practicable waterproof-fireproof is an improvement not yet fully developed. Fireproofing compounds in use are generally extremely soluble; as, for instance, ammonium sulphate, calcium chloride, etc. They cannot very well be applied in combination with either of the waterproofing methods. If the waterproofing is good the fireproofing is poor, and vice versa. Considerable work remains to be done on this problem.

Summary: Waterproofing by the aluminum-soap method is carried out as follows: The cloth is passed through the following waterproofing bath:

100 to 200 gallons water
20 to 100 pounds soap
10 to 50 pounds filler (rosin, stearine, glue, etc.)
Dyestuff

at a boiling temperature, through squeeze rolls, and into a drying chamber. The liquor carried from the bath is replaced by a pipe line from a side bath. After drying, the cloth is run through a bath made up as follows:

100 to 200 gallons water
50 to 100 pounds lead acetate
50 to 100 pounds aluminum sulphate
1 to 2 pounds copper sulphate

at 12 deg. Fahr. The lead sulphate has previously been allowed to settle off in tanks. In case vegetable dyes have been used, this aluminum bath must contain the required quantity of chrome for developing. The cloth passes through squeeze rolls into the drying chamber and out to be rolled up.

The paraffining method is carried out as follows: Run the cloth through a hot solution of paraffine, rosin, asphalt, etc., in benzine, through internally heated steel squeeze rolls, then into a lukewarm drying chamber carrying a good current of air, and thence onto rolls.

The waterproofing business is suffering probably as much as any other kind of industry in the present slump. The tremendous demand during the war for the type of goods given the treatment caused the

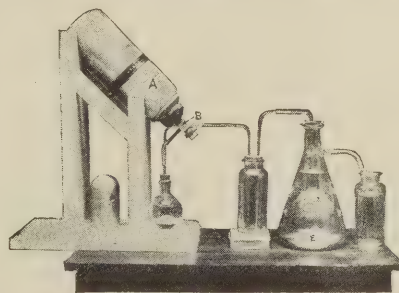
springing up of many mushroom companies, with the result that warehouses were full of waterproofed material when the war ended. Not much of the cloth waterproofed ever reached France. The peace-time demand for such goods is very small. People live in houses now, rather than in tents, and their goods are stored in wooden buildings rather than in open fields. Consequently, the liquidation of the stored-up cloth by the Government has been a slow proposition, and its stock of surplus duck is even yet a large one. This, together with the struggle of the war-nourished companies to stay in the game, makes it a rather unprofitable business at the present time, with scant hopes of improvement for a few years to come.

APPARATUS FOR DEMONSTRATING PROPERTIES OF LIQUID CHLORINE

IN connection with the paper, "Handling Liquid Chlorine," by D. K. Bartlett, Vice-President, Electro Bleaching Gas Company, New York City, published in *The Reporter* of November 7, 1921, a demonstration was made of some of the properties of liquid chlorine, to give a clearer idea of the nature of the product as well as the relative ease with which it can be controlled, when the paper was presented before members of the National Safety Congress at Boston.

What was done was to run some liquid chlorine from a cylinder into a glass flask to show its appearance, and also to show its slow rate of evaporation without the application of heat.

The accompanying illustration shows the apparatus as set up. A ten-pound cylinder (A) was tipped up in a



Apparatus Used in Liquid Chlorine Demonstration

rack so that liquid instead of gaseous chlorine would run out when the valve (B) was opened. The round flask (C) caught the liquid. The gas that boiled off during the experiment passed through the guard bottle (D) and was absorbed in caustic soda solution in the two bottles (E) and (F). When the valve on the cylinder was opened the first liquid that ran out immediately evaporated until the valve, tubing and flask (C) were chilled by the evaporating liquid to -33.6 deg. Cent., the boiling point of liquid chlorine. This took only a few minutes, as the evaporation of a kilogram of liquid chlorine absorbs about 67 calories. In other words, a pound of liquid chlorine, in evaporating, will cool about two pounds of water at the boiling point to room temperature. About an ounce of liquid chlorine was run into the flask. This

boiled quietly for over an hour before the last drop passed off in gas form.

While there was nothing spectacular or novel in the experiment, it really gave a small-scale demonstration of what is done by practically every liquid chlorine user in

his daily routine; that is, the evaporation and absorption in some medium of the greenish-yellow gas which has grown to play such an important part in so many industries since its isolation by Scheele and its taming (as a liquid) by Knietsch.

Primulin and Its Different Colored Effects

By RAFFAELE SANSONE

PPRIMULIN, although a comparatively old color, and very well known to many dyers of cotton fabrics as such—or as polichromine, thiochomogene, aureoline and auoline—is still liable to many future applications, especially at present, when coloring matters are still so expensive and it is still advantageous to utilize the special properties of the different products on the market to a better advantage than has so far been possible, using mechanical means whenever they can cheapen the price of treatment, or bring about a saving on labor, space and time. For accomplishing such a purpose with primulin, however, it is necessary to study closely not only the processes and plants so far employed, but also those that may be necessary for obtaining special results quite impossible at present.

PROPERTIES OF PRIMULIN

Primulin is a dirty yellow powder, easily soluble in water, and producing solutions which, when sufficiently diluted, have a blue fluorescence. It produces on cotton goods a yellow which, owing to its limited fastness to light, finds practically no employment in the dyehouse in the untreated state, chrysophenine and other direct yellows being preferred to it. The color is, however, still employed on a certain scale in some parts, after diazotization and development with special baths, for producing shades and colors fairly fast to light, fast to water, fast to soaping, and in some cases even fast to bleaching powder solutions or baths. In accordance with the developing bath employed, reds, oranges, yellows, clarets, maroons and carmines can be produced which always possess more fastness than the original primulin.

THE DYEING OF PRIMULIN

Primulin is best dyed in a neutral bath having, for light shades, from 1 to 10 per cent of common salt, or calcined sulphate of soda, on the weight of the goods treated, and not more than 1 per cent of the coloring matter; for medium shades, from 10 to 15 per cent of common salt and from 1 to 2 per cent of coloring matter, while for dark shades from 15 to 25 per cent of common salt and from 2 to 4 per cent of coloring matter. For light shades the dyeing can be conducted below the boil, whereas for medium and dark shades it is best conducted at the boil.

PRIMULIN REDS

Reds are obtained on primulin yellow dyed cotton goods by treating these, while still wet from rinsing bath following the dyeing process, in the cold for one-half hour, with a bath containing from 1½ to 2½ per cent of nitrite of soda, and from 5 to 5½ per cent of hydrochloric acid at 22 deg. Baume, on the weight of the goods. After this the cotton material is taken out of the bath, and is left in a heaped condition with the view of assuring complete diazotization, being then rinsed and entered in a developing bath containing nine parts of beta-naphthol and nine parts of caustic soda lye at 40 deg. Baume for every thousand parts of cotton goods treated, and what water is just necessary for covering the goods. In this bath they are treated for one-half hour, also in the cold, being then again rinsed, slightly soaped, if necessary, and dried, ready for the final finishing operations.

A LESS BRILLIANT RED

A less brilliant red is obtained by treating the diazotized paranitraniline goods with a bath containing 0.35 to 0.7 per cent of meta-toluylylene-diamine and 0.3 to 0.6 per cent of carbonate of soda, dissolved in the least possible quantity of water. When the quantity of water is twenty times the weight of the material being treated the above quantities have to be somewhat increased, or they will be too weak in their action.

PRIMULIN CLARETS

A yellowish claret is obtained by using, for every 100 pounds of diazotized primulin dyed goods, fifteen pints of the following solution, employing as little water in the dyeing apparatus as possible: 9 pounds of phenylene-diamin and 3 pounds of soda ash are dissolved in 20 gallons of boiling water.

ANOTHER TYPE OF CLARET

Another claret is obtained by developing diazotized primulin dyed goods in a bath containing 10 parts of alpha-naphthol per thousand parts of cotton goods, and dissolved in 10 parts of caustic soda lye at 40 deg. Baume, using in the bath treatment just enough water to produce a short bath.

DULL YELLOWS AND ORANGES

The developing baths for producing dull yellows and oranges on diazotized primulin dyed goods are several, and some of them have more value than others as regards the higher degree of fastness obtained. The products employed for the production of such colors are carbolic acid, carbonate of soda, etc. With bleaching powder solutions or diazotized paranitraniline a yellowish orange is obtained on goods dyed with primulin that have not been diazotized.

WITH CARBOLIC ACID

When carbolic acid is employed, from 0.3 to 0.6 per cent of this product is used on the weight of the goods, and this is dissolved in 0.9 to 1.8 per cent of caustic soda lye at 22 deg. Baume, and the resulting solution is poured into the developing bath generally prepared with ten times its weight of water. The orange obtained in this instance resembles that of some brands of phosphine; it is, however, of medium fastness to light, hot pressing, chlorine, etc. This treatment is resorted to when shades fast to acids and soaping are required.

WITH DIAZOTIZED PARANITRANILINE

With diazotized paranitraniline a similar orange is obtained, but one which is much faster to light and has good fastness to washing, being used mostly for shading brown colors on the yellow side, and as a yellow element in mode shades. The bath of treatment usually prepared for the purpose is as follows, when treating 1,000 kilos of cotton goods dyed with primulin, and not diazotized:

- 10 kilos of paranitraniline in powder are made into a paste with
- 50 kilos or liters of water, adding to the paste
- 25 parts of hydrochloric acid at 21 deg. Baume, and agitating until a clear solution has been produced.
- After one-half hour
- 300 kilos of cold water are added, following this soon after by
- 5.20 kilos of nitrite of soda, dissolved in
- 30 kilos of water, agitating all through, and allowing to rest for one hour. The impurities that separate on the upper surface of the bath are then eliminated by filtering through a cotton cloth sieve straight into the bath of treatment; to which five kilos of calcined carbonate of soda and ten kilos of acetate of soda have already been added.

WITH CARBONATE OF SODA

In some cases it is found advantageous to follow the diazotation of primulin simply by a bath of carbonate of

soda. In this instance the goods are treated at 120 deg. Fahr. for one-quarter of an hour in a bath containing five ounces of soda ash for every ten gallons of water. After this the goods are simply rinsed as usual and soaped.

WITH BLEACHING POWDER

When primulin dyed cotton goods are treated with bleaching powder solutions, this takes place, after the usual rinsing, for one-quarter of an hour at 25 deg. Cent., and in a bath containing one-half liter of a solution of hypochlorite of lime at 10 deg. Baume per 100 liters of water in the bath of treatment. After this they are rinsed again in plenty of water until there is no further trace of chlorine.

Other dyers treat the above goods in a bath of hypochlorite of lime at 1 deg. Tw., rinsing, souring with hydrochloric acid, and again rinsing thoroughly. A yellowish orange thus results which has very good fastness to chlorine, washing, light, stoving and hot pressing. When produced on cotton yarn, and interwoven with woolen yarn, it resists the cross dyeing of union goods in an acid bath.

PRIMULIN BROWNS, ETC.

Orange browns are obtained with resorcin, by using in the necessary bath of treatment fifteen pints of the following solution for every hundred pounds of diazotized primulin goods treated:

- 11 pounds of resorcin are dissolved in
- 24 pounds of caustic soda lye at 77 deg. Tw. and
- 20 gallons of water.

Besides the above colors, a claret is produced with benzyl naphthylamin or ethyl-beta-naphthylamin, a maroon with salt B, and a carmine with alpha-naphthol-sulphonic acid; and through mixtures of the bases resorcin, beta-naphthol, alpha-naphthol, meta-phenylene diamine, meta-toluylene diamine, between themselves, or with carbolic acid, quite a series of other colors are produced.

THE PLANT ADOPTED

The plant generally adopted in most dye works, when treating primulin dyed fabrics, is that generally employed for the usual dyeing processes with direct coloring matters, and can consist of padding machines, jiggers, continuous dyeing machines, etc., the treatment never having been considered of very great importance, especially in view of the fact that other more brilliant colors could be dyed with greater ease, and more cheaply. There is no doubt, however, that the diazotized and developed colored effects are at present well worth the use of a special plant, if this can give added advantages not possible when handling most other direct colors.

A FUTURE POSSIBILITY

A future possibility will be to produce, in continuous form and in one run, from a large quantity of material dyed with primulin yellow in the most convenient shade, a comprehensive series of colored fabrics to be sold for special purposes. For attaining this end the comparatively simple dyeing, diazotizing and developing plant shown in Fig. 1 could be adopted to advantage, being modified more or less in accordance with the production, local conditions, capital at disposal, etc.

This shows a plant composed of a single continuous dyeing machine (A), of a rinsing vat (B), of a diazotizing machine (C), of a second rinsing vat (D), of a four-vat developing apparatus (E), and of a quadruple hot-air drying machine (F), where four pieces of cotton cloth are dyed two by two, and are diazotized, developed, rinsed and dried one by one.

The construction of the dyeing machine (A) and first rinsing vat (B) is somewhat more complicated than is

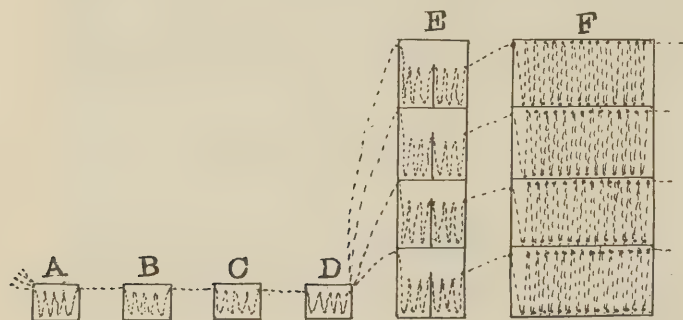


FIG. 1—A Simple Dyeing Plant for Handling Large Quantities of Material in One Run

the case with the usual continuous machines. The working principles of both are indicated in Fig. 2.

This shows a rectangular wooden, or copper, vat (V), having a lowest series of guiding rollers (l, l, l, l, l, l) close to the bottom of the vat, a slightly higher series of guiding rollers (h, h, h, h, h, h), a first series of squeezing rollers (s, s, s, s, s, s), and a second, or uppermost, series of squeezing rollers (S, S, S, S, S, S). For entering four boiled out and bleached fabrics simultaneously (a, b, c, d), the front portion of the vat is supplied with two pairs of squeezing rollers (e, f) which admit the material in two separate lots of two pieces, while for carrying them out at the end the machine contains another two pairs of pressing rollers (k, m). The dye bath is entered in this instance at the end of the vat, and makes its way slowly through the goods, passing out by an overflow tube at the front of the vat. It is prepared in a separate and somewhat higher placed vat, to which all overflow escaping from the treatment vat is pumped back. The material, on passing through the plant, is impregnated and pressed with the bath several times, and makes its exit from the first vat (A) of one uniform color, and from the second or rinsing vat (B), for being diazotized (see Fig. 1).

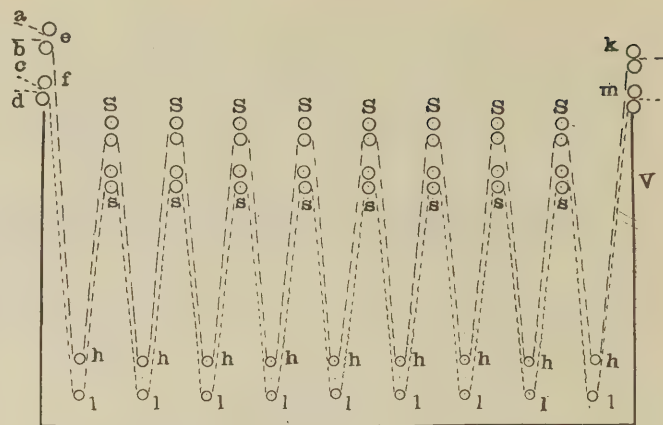


FIG. 2—Working Principles of Dyeing Machines and Rinsing Vat Shown in Fig. 1

THE DIAZOTATION VAT

The principle of the diazotation vat and second rinsing vat is indicated in Fig. 3.

This shows a high copper vat (W), having four entrance pressing rollers (a, b, c, d) and four exit pressing rollers (f, g, h, i). The interior of the vat is supplied with several series of lower rollers and several series of four upper pressing rollers (A, B, C, D, E, F, G), between which the four dyed cotton fabrics are treated quite independently from one another with the diazotation and last rinsing bath, being pressed between each impregnation, and can be conducted after the rinsing to the four-vat developing plant, each vat of which contains two compartments, one for the treatment with the developing bath, and the other for the rinsing of the treated fabric in running water. Each vat is supplied with a lower series of guiding rollers, and with an upper series of squeezing rollers, so that the material is pressed even in this instance between each impregnation, and can make its way, leaving the rinsing bath, straightaway to the corresponding drying chamber, from which it comes out for being calendered and finished off, or for being simply rolled on wooden shafts, ready to be carried to any other department in the works, or to any machine for further treatment.

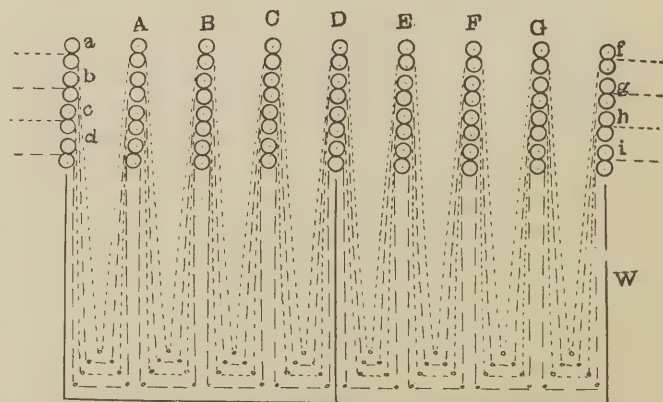



FIG. 3—Working Principle of Diazotization Vat

A black and white portrait of Oscar R. Flynn, a man with a mustache, wearing a suit and tie, framed in an oval.

MEN OF MARK in the DYESTUFF FIELD

OSCAR R. FLYNN

Head Chemist

Waldrich Bleachery

Delawanna, N. J.

WHEN the World War shut off America's supply of dyes, Oscar R. Flynn decided that the Waldrich Bleachery, which he served in the capacity of Head Chemist, could do better than buying highly adulterated dyestuffs at ruinous prices. He accordingly obtained a supply of dimethylaniline, one of the few intermediates obtainable at that period, and with no equipment but a galvanized iron tray on a sand bath, and the apparatus of his laboratory, he contrived a special method for the production of Methyl Violet involving the leaching out of the copper by a solvent which left the desired color base undissolved.

Two-hundred-pound lots were the initial output, and the advantage to the mill was great. However, a single color did not begin to satisfy the need, and, realizing this, he next successfully accomplished the conversion of nitrobenzol into benzidine, from which he made a satisfactory Chrysamine, 7 per cent paste. Then followed in succession Congo Violet, Orange R, Congo Red, 4 per cent paste; Benzopurpurine 4B, Direct Blue 2B and Direct Green G—all more dependable than similar types on the market at that time. Nor does this complete the tally; under his direction the Waldrich Bleachery has since succeeded in producing for its own use Direct Cotton Fast Yellow, Brown, Red and Pink, all of which are fast to acid and to alkali, as well as an Acid Fast Orange.

In those early days, most of the equipment was made in the mill. None was purchased or even constructed until the manufacture of the dye was first proved to be feasible on a small scale and then in quantities sufficient for mill use, thereby obviating the danger of piling up a large amount of useless and expensive machinery. Now the mill possesses equipment which includes a 40-chamber filter press and dryer for the production of colors in powdered form, and it continues to manufacture certain dyestuffs which can be produced as cheaply as purchased.

Mr. Flynn received his education and degree of B.Sc. at Ohio State University. Graduating in 1896, he pursued his graduate studies at the University of Chicago, leaving this institution to become a teacher of chemistry, first at Columbus, Ohio, later at Hyde Park High School, Chicago, and High School of Commerce, New York. While in this last position he acted as Consulting Chemist to the Waldrich firm, subsequently devoting his entire time to the mill when the German color supply began to fail.

He has specialized on the chemistry of cotton bleaching, dyeing and finishing, and has developed a method of applying wood dyes to cotton by a one-dip process. He has also perfected an improved method of dyeing Para Red, and has made special studies of emulsions in their application to polishes, cotton softeners, bleaching assistants and the scouring of cotton in the open width. He is the author of a system of chemical stenography and has carried on research work on the methods of detecting causes of stains and other defects in dyeing operations. He is a member of the Chemists Club of New York and has contributed various articles to technical journals on the application of dyes to cotton, while his educational work has consisted principally in the adaptation of the chemistry of commerce to instruction in high schools.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

D. A. L.—*Question:* We dye cotton velour, with 4 per cent Oxamine Blue A, 2 per cent Monopole Oil, 10 per cent Glauber's salt, 5 per cent common salt. After-treated in fresh bath with 2 per cent copper sulphate and 1½ per cent acetic acid for one-half hour at 160 deg. Fahr., then well rinsed. We find when goods are finished that what appears to be oil spots are found on face of the fabric, also small particles of undissolved dyestuff. Color solution is strained through a fine mesh strainer before being added to bath. Is it advisable to after-treat cloth in same tub in which goods have been dyed? Is it possible that the copper sulphate the wood has absorbed has some injurious effect on the color, makes some part of it insoluble? I am sending you some of the fabric in which these spots appear. Will appreciate any information you may be able to give us.

Answer: We believe that the problem is solved by you yourself when you state that you find small particles of undissolved dyestuff on the face of the fabric after dyeing. It seems to us that this, no doubt, is the cause of all the trouble. We would suggest that the dyestuff be dissolved with great care and then strained through a piece of closely woven cotton material instead of the fine mesh strainer which is now being used. The cotton material should be wet out before the dye solution is strained through it. We do not see anything wrong with the method of dyeing employed nor do we think that the wood of the dye vat absorbs enough copper sulphate to cause any trouble in subsequent dyeing operations.

R. M. H. Co.—*Question:* What are the reasons for not using Epsom salts as a substitute for Glauber's salt in the dye bath? We note the solubility of the former is twice that of the latter. Its use has been recommended to us in one instance, and we wonder what the objection could be for other dyes.

Answer: It is true, as you say, that Epsom salts, which is sulphate of magnesia, is more readily soluble than Glauber's salt, which is sulphate of soda. When used in dyeing operations, however, the sulphate of magnesia has a tendency to form certain compounds which inter-

fere with clear dyeing when used in conjunction with most aniline dyes, whereas the sulphate of soda does not. There are some few exceptions to this general rule and it is probably in one of these cases that Epsom salts has been recommended to you.

O. T. Co.—*Question:* Can you advise us where we may obtain a light that may be used in matching of colors in our dyehouse at night? About ten years ago there was a light on the market known as the Moore light. They cost at that time \$250, gave a very satisfactory light, but got out of order very often. We are looking for a cheap light, as we may not have to run the dyeing department very long nights. Would you advise a dyehouse to match all colors in artificial light, the color value of the light being the same at all times?

Answer: We would refer you to the Macbeth Daylight Company, 227 West Twenty-seventh Street, New York City, for the type of lamp which you need for matching colors at night.

The manufacture of the Moore light, we understand, was discontinued during the war, and the Macbeth Company are providing a range of 150 models and sizes of lamps ranging in price from \$25 to \$250 apiece. These charges are complete for the entire outfit, but do not include express charges.

The type of lamp used to-day by a great many dye manufacturers and dye consumers is known as the "CP 40," priced at \$110. It has been in use five years, and is guaranteed by the maker to furnish from two test sources reproductions of both artificial light and daylight. Both of these can be applied to the match without moving samples, and can be changed instantaneously.

We should not advise depending upon artificial daylight when good natural daylight is available. It is, at best, only a substitute and, while probably quite accurate when properly used, cannot be expected to improve upon nature.

Review of Recent Literature

Action of Dilute Sulphuric Acid on Cotton Cellulose, and an Improved Method of Testing for Oxycellulose. Edmund Knecht and F. P. Thompson; communication in *Journal of the Society of Dyers and Colourists*, November, 1921; p. 270.

Authors find that (1) Cotton which has acquired an increased affinity for Methylene Blue and a decreased affinity for Diamine Sky Blue by treatment with dilute sulphuric acid is not oxidized cellulose, but contains fixed sulphur which is not removed by washing with boiling water or alkali.

(2) The characteristic affinity of Chardonnet silk for

basic colors is due to the sulphur (or sulphuric acid) fixed during the nitration with mixed acids and not during denitration.

(3) The affinity of oxidized cellulose for leuco Methylene Blue is very slight, whereas it is very marked in the case of the sulphuric acid product.

(4) Oxidized cellulose and sulphuric acid treated cellulose may be distinguished by boiling with weak alkali and then dyeing with a direct color (Methylene Blue).

Textile Design and Colour. William Watson, London, England.

The author found it necessary to divide his subject into two volumes, the one noted above treating particularly of cloths which are composed of one series of warp and one series of filling threads, and the other, under the title, "Advanced Textile Design," of compound and special classes of cloth. The work under discussion is the second edition and is marked by considerable addition and revision to the subject matter dealing with the designing and coloring of elementary weaves and figured fabrics.

New material has been added in an appendix on "Standard Yarn Weaves and Fabrics," and an attempt has been made to feature especially examples which possess some marked characteristic of structure or mode of manufacture. The present volume is copiously illustrated with various designs and examples of woven fabrics.

British Patent 146,078. J. F. King, Philadelphia.

Herein is described a novel bleaching composition and a process which can be applied to any textile material. Foreign matter in raw cotton is removed; loss of weight, which is rare, seldom exceeds 2 per cent; loss in tensile strength is decreased, and the complete bleaching action takes approximately two hours.

The compound used is a solution containing sodium chloride, a peroxide, and Glauber's salt; to which can be added detergents such as caustic soda or sodium carbonate. Example: By weight, 10 common salt, 10 soda ash, 6 hydrogen peroxide, 10 caustic soda and 24 Glauber's salt. For 1,000 pounds of material, 60 pounds of the foregoing is dissolved in 500 gallons water; but if it is desired to dye the material the process may be carried out with substantially one-half the bleaching composition for about one-half the time necessary for a complete bleach. After bleaching, the material is boiled and afterwards rinsed.

The dye may be prepared by the formation of a paste by mixing the dyestuff with a little warm water and dissolving four ounces in two gallons cold water. This dye solution is added to the cold water rinse, the material being allowed to stand therein for about five minutes. Contents of vat are then heated to about 130 deg. Fahr. Five minutes will produce a light shade; substantially

any desired shade is obtained by varying the length of time beyond this.

In this process, the caustic agent in conjunction with the sodium carbonate cleanses the material of impurities, while the other constituents effect the bleaching action. If materials are already free from impurities, the carbonate and caustic may be omitted. While the solution in the foregoing is alkaline, acids may be substituted as demanded by various classes of material handled.

Recent Patents

Bleaching, Dyeing, Washing and Soaping Cylinder for Knitting Mills, Dyehouses, Bleacheries and Laundries

(1,391,712; September 27, 1921)

DEAN BROWN BECKER

The device described, for treating textiles with liquids, comprises a casing, a foraminous cylinder mounted for rotation therein and having opposite doors in the outer annular wall thereof; the cylinder having opposite ends provided with pairs of ribs with grooves in alignment between the doors, adapted for the removable reception of perforated slotted, or foraminous, shelves at adjustable elevations.

Color-Base for Leather Finishes, and Method of Making Same

(1,393,697; October 11, 1921)

JOHN H. PFINGSTEN (assignor to Presto Color Company, Cudahy, Wis.)

This consists of a concentrated color-base suitable for making leather finishes comprising a finely ground pigment, water soluble oil, and water, and containing a small amount of mercuric chloride.

Machine for Washing, Saturating and Similarly Treating Textile Fabrics and Yarns in Rope Form

(1,391,276; September 20, 1921)

FREDERICK ROBERTS (assignor of one-half to The Calico Printer's Association, Ltd., Manchester, England.)

The device described consists, in a machine for treating textiles in rope form, of the combination of a liquid receptacle divided into a plurality of compartments each having a perforated false bottom, each compartment communicating with a succeeding compartment below the false bottom thereof; means for supplying a liquid to the last compartment of the series, means for conducting a rope of textile material into and out of successive compartments—the direction of progress of the rope being counter to the flow of liquid through the receptacle—and adjustable means for guiding the rope in its passage from one compartment to another.

Manufacture of Artificial Silk

(1,393,199; October 11, 1921)

EMILE BRONNERT

This process of producing viscose silk of any desired fineness from raw viscose of various consistencies comprises forcing the viscose through suitable openings into an acid precipitating bath, the concentration of which is increased proportionately to the increase in the fineness of the thread desired to be produced, the increase in the consistency of the viscose employed, and the increase in the size of the openings through which the viscose is forced.

Dyeing Machine

(1,390,512; September 13, 1921)

HOWARD M. DUDLEY

This device consists, in a dyeing machine, in combination: a dyeing chamber, two series of spaced parallel bars capable of holding skeins in a substantially taut condition, and means for circulating a liquid in reverse directions through the dyeing chamber parallel to the length of the skeins.

Finishing or Lustring Textile Fabrics

(1,393,296; October 11, 1921)

JOSEPH BOLTON LOMAX

This describes the process of finishing textile fabrics which consists in passing a fabric between a plurality of rollers under high pressure, and while hot applying thereto a boiling finishing liquor while retaining the fabric under tension; then winding the fabric into a roll while still hot.

Azo Dye and Its Process of Manufacture

(1,395,238; October 25, 1921)

ROBERT ARNOT

Claim is made for the diazonium compounds of retene which form, with R salt, reddish to violet dyes; with G salt, brown to brown-red dyes; with Andersen's salt, reddish dyes, and with H acid, violet to purple red dyes.

Process of Mineralizing Hair, Wool and Other Animal Fiber, and the Product So Produced

(1,394,655; October 25, 1921)

ALBERT O. TROSTEL

This describes the process of rendering animal fiber shrinkable by the action of heat while resisting the destructive action of such heat, and comprises making the animal fiber porous by chemical reagents, removing the reagents and any by-products formed thereby, and then mineralizing the fiber thus prepared by treatment with solutions adapted to deliver relatively large amounts of mineral matter to such fiber.

Dyeing Machine

(1,395,165; October 25, 1921)

JAMES H. THOMPSON (assignor to Hussong Dyeing Machine Company, Groveville, N. J.)

This is the combination in a dyeing machine of a vat having a solid structure at one end, with vertical cylindrical passages of an even diameter throughout and rotating circulating propellers of substantially the same size as the passages, and mounted therein.

Apparatus for Use in Connection with Machines for Bleaching, Dyeing, Finishing and Otherwise Treating Fabrics

(1,396,980; November 15, 1921)

JOHN THORNER (assignor to Bradford Dyers' Association, Ltd., Bradford, England)

This describes a vehicle with bearings carried thereby to receive a rotary shaft, coupling devices for securing this vehicle to a machine, detachable means carried by the machine to allow the release of a roll of fabric therein, means for allowing this fabric to roll from the machine to the vehicle; these means consisting of detachable arms and detachable pins for retaining the roll in position on the vehicle.

Manufacture of Anthraquinone Derivatives, and New Products Resulting Therefrom

(1,394,851; October 25, 1921)

ARTHUR LUTTRINGHAUS and LUDWIG EIFFLAENDER (assignors to Adolph Kuttroff, New York City)

This is a process of manufacturing anthraquinone derivatives substituted by at least one aryl-amino group which consists in treating an amino-anthraquinone compound with a metal arylide in the presence of a primary aromatic amino compound.

Dyeing Machine

(1,395,669; November 1, 1921)

HOWARD M. DUDLEY

The apparatus described consists—in a dyeing machine, in combination—of a receptacle, a stationary shaft passing through the receptacle, a revoluble sleeve supported by the shaft, means for revolving this sleeve, a series of foraminous dyeing chambers carried by the sleeve within the receptacle, a chamber surrounding the foraminous dyeing chambers, means whereby a liquid may be introduced simultaneously and continuously into all portions of one end of the surrounding chamber, and means whereby a liquid may be passed through dyeing chambers and subsequently through the receptacle.

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